TECHNOLOGY DEPARTMENT

Gas Journal

Vol. 254. 100th Year. LONDON, JUNE 16, 1948. No. 4437. Price 2/-

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JUL 2 - 1948
DETROIT

ASCOT gas water heaters are enlisted in the Nation's service in an all-out effort to make fuel supplies go round. Read what the British Gas Council says in its report to the Chancellor of the Exchequer :—

"In the interests of fuel economy, hot water should be provided by the most efficient means available, namely, the water heater which has been developed expressly for the purpose and none other."

Ascot heaters save fuel because they give hot water *when* and *where* it is needed.

ASCOT

A MILLION ASCOT GAS WATER HEATERS ARE HELPING IN THE BATTLE TO SAVE FUEL

ASCOT GAS WATER HEATERS LIMITED · 43 PARK STREET LONDON · W1 · GRO 4491

WE ARE EXPERT IN DISMANTLING GAS WORKS PLANT

Progress demands the complete replacement of redundant Plant. Dismantling is a major undertaking and calls for the experience of experts. We can complete the task with the minimum interference to your normal working procedure.

JAMES N. CONNELL

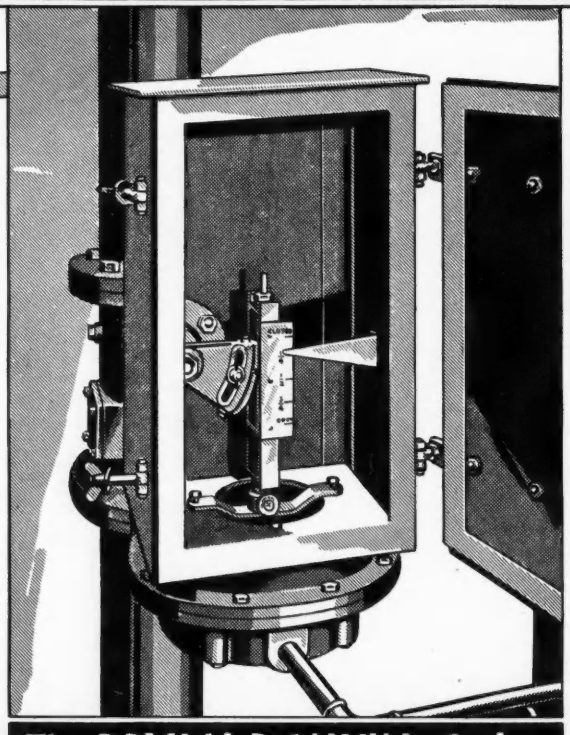
PHOENIX & CLIFTON IRONWORKS
COATBRIDGE, SCOTLAND
TELEPHONE COATBRIDGE 1121/5 TELEGRAMS CLIFIRON, SCOTLAND

Donkin

RETORT HOUSE GOVERNOR

- Diaphragm Type with relay control.
- Foul Gas does not come in contact with Relay System.
- Suitable for any type of Retort, horizontal or vertical.
- Adaptable to existing settings.
- Running cost nil.
- Accurate control.

We have a large number of these Governors at work, all giving the greatest satisfaction—with repeat orders. These Governors have replaced other types.



The BRYAN DONKIN Co LTD.
CHESTERFIELD

An R. & J. D. Ltd. "Multi-pass Vertical" set.

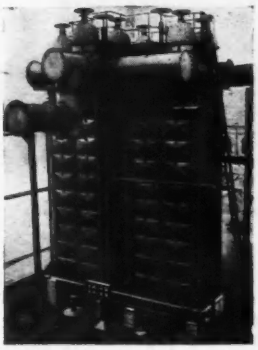
1885 1948

The symbol of Efficiency and Service

Condensers of Distinction

If you require annular, pipe, or water-cooled condensers of cast iron or mild steel construction and with either horizontal or vertical tubes, please consult us

A twin set of R. & J. D. Ltd. "horizontals."



More R. & J. D. Ltd. horizontals.

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SPECIALISTS IN THE DESIGN • MANUFACTURE • & ERECTION OF BY-PRODUCT PLANT • CONDENSERS • DETARRERS • GASHOLDERS • PURIFIERS • TANKS • WASHERS • WATER GAS & HYDROGEN PLANT • & OTHER TYPES OF GAS & CHEMICAL PLANT & ACCESSORIES

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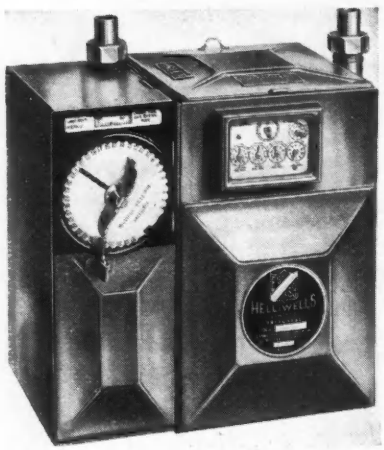
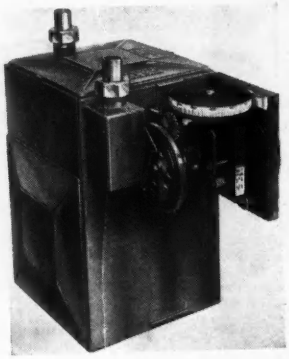
A

METERS by Helliwells

WITH OR WITHOUT PRE-PAYMENT DEVICE





The four features of the Helliwell prepayment mechanism, shown here, warrant the careful consideration of the Gas Engineer.

1. Complicated gearing has been avoided, and the mechanism is consequently rendered absolutely trouble-free.

2. The mechanism can be supplied to operate with pennies or shillings only. Alternatively, it can be supplied as a Company's optional Bi-coin meter, in which case changing from pennies to shillings or vice versa, is a simple matter involving only a minute or so to accomplish. This can easily be carried out *in situ*.

3. A device is incorporated which, in the event of a dirty valve, etc., will "cash balance" the meter ; the fact that unpaid-for gas has been passed is indicated to the consumer by the red figures on the prepayment dial. Thus the Company and the Consumer are safeguarded and the mechanism is protected from strain.

4. This device can also be utilized to provide gas for a by-pass to refrigerators, etc., after the main supply has been shut off.

Messrs. Helliwells Ltd. will be pleased to arrange demonstrations and technical consultations with Gas Engineers on application to either the Treforest factory or the head office at the Airport, Walsall.

Helliwells Ltd
TREFOREST TRADING ESTATE
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GLAMORGANSHIRE

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THE AIRPORT
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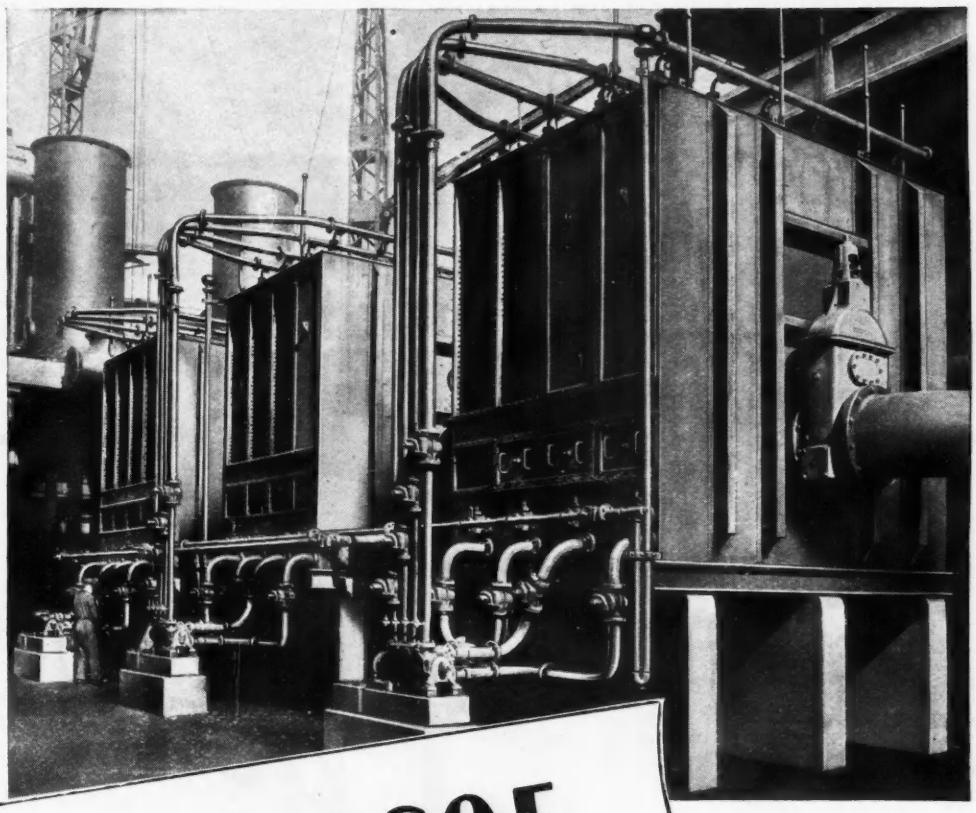


Constructional view of a large capacity 12 bay Whessoe Static Scrubber for ammonia extraction, supplied to the South Metropolitan Gas Company.

THE WHESSOE MULTI-STAGE STATIC SCRUBBER

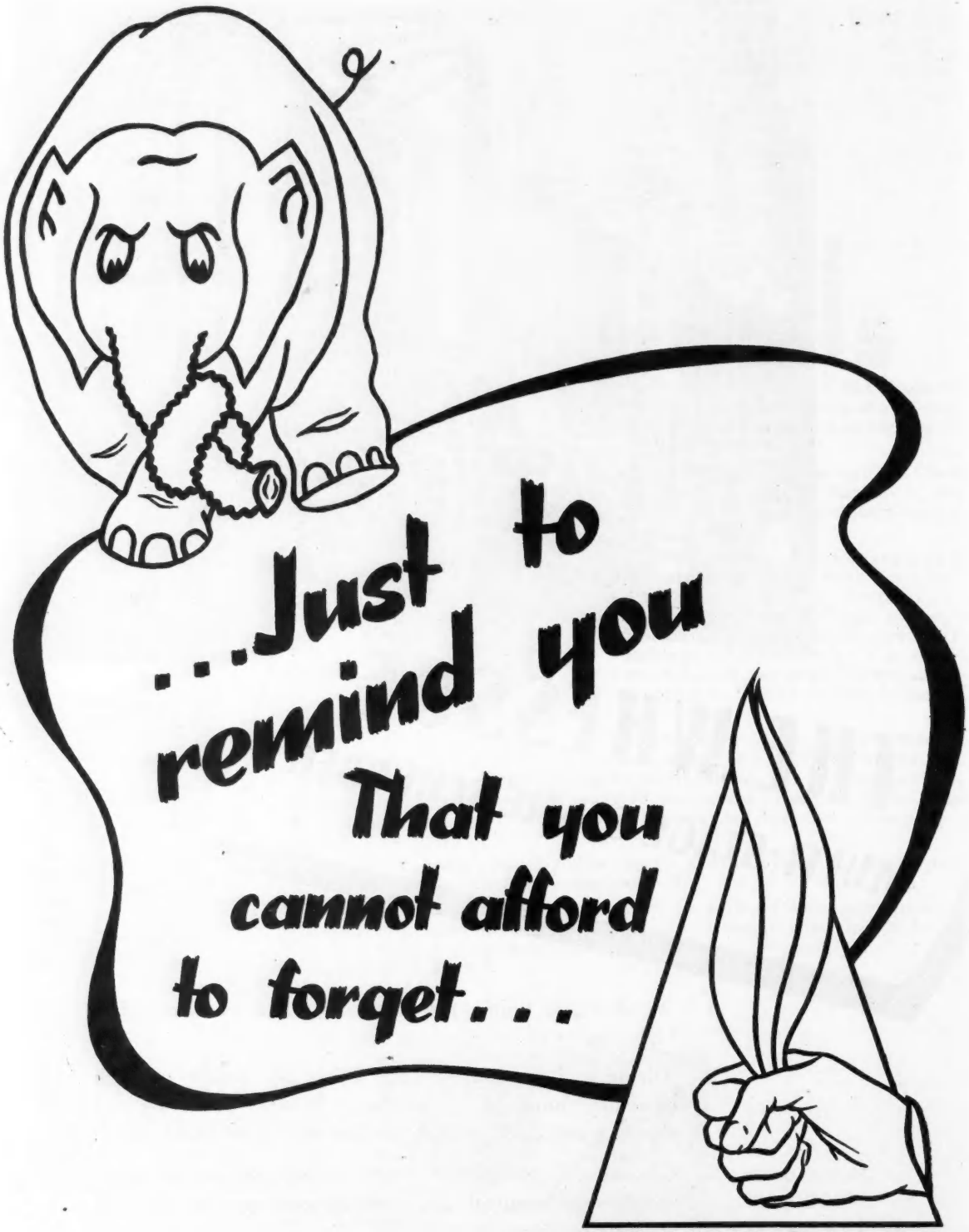
FEATURES

1. Wooden grid filling, providing a washing surface with a high degree of sub-division and uniformity.
2. Adequate irrigation of this filling by means of high efficiency mono-bloc centrifugal pumps, providing the simplest and most reliable method of liquid recirculation.
3. Guaranteed performance, not merely of ammonia or naphthalene removal, but of corresponding enrichment of washing medium.

WHESSOE DARLINGTON

WHESSOE LIMITED DARLINGTON

HEAD OFFICE AND WORKS, DARLINGTON TEL. DARLINGTON 5234
LONDON, 25 VICTORIA STREET, S.W.1 TEL. ABBEY 3881


...Just to remind you
That you cannot afford to forget...
CONTROLLED
FLAME BOILERS LTD
THERMAL HOUSE, 10 PARSONS GREEN S.W.6
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First
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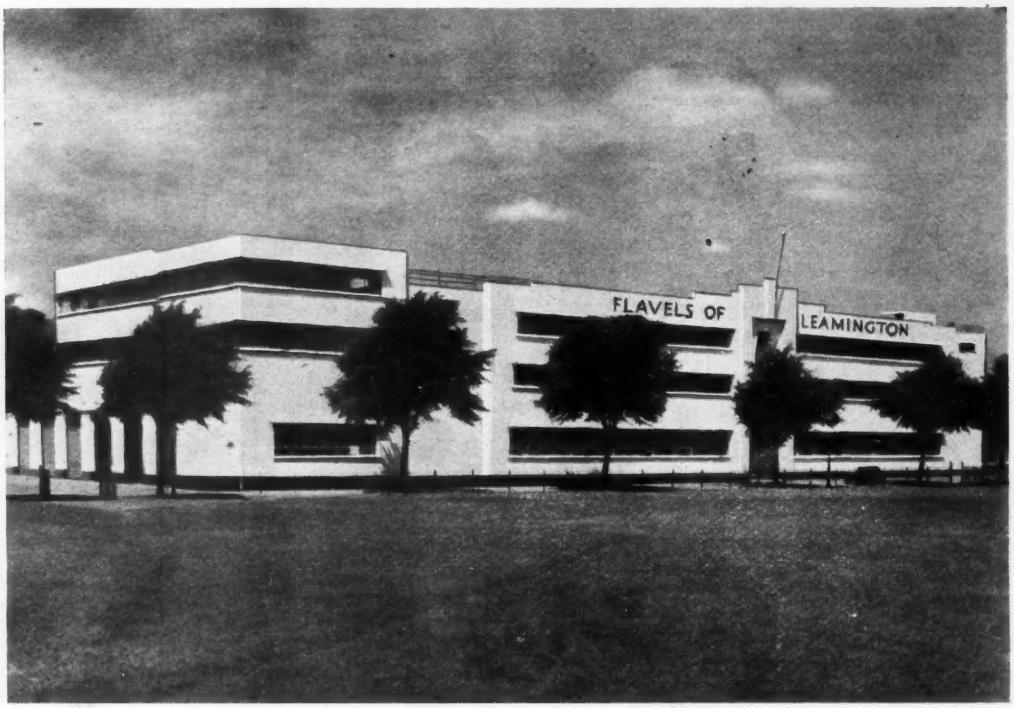
Domestic
Science
cannon



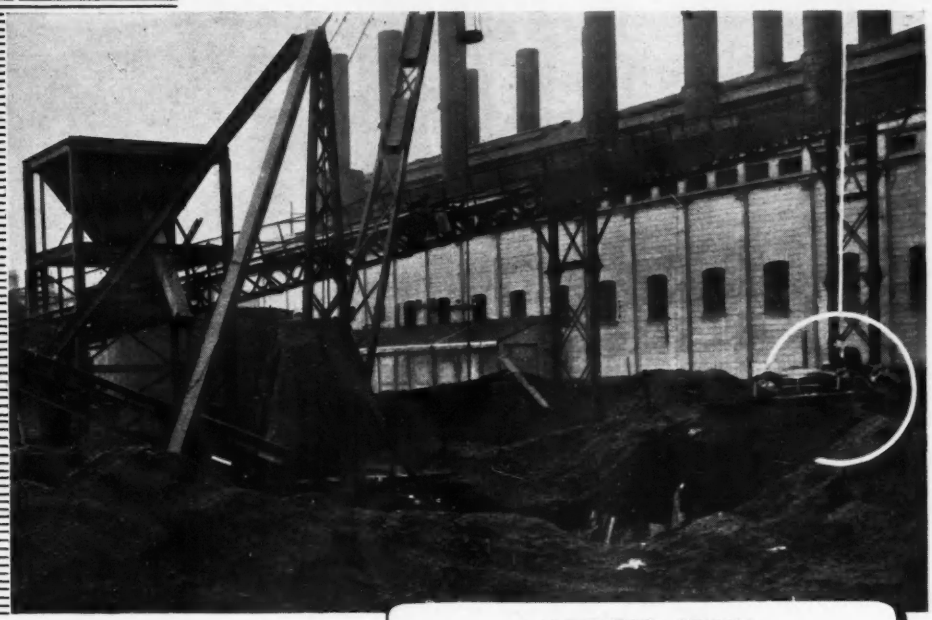
THE new Flavel factory with its up-to-date plant and machinery, exemplifies the spirit of progress and enterprise which has made the Company's name a by-word for fine quality products through nearly two centuries of trading.

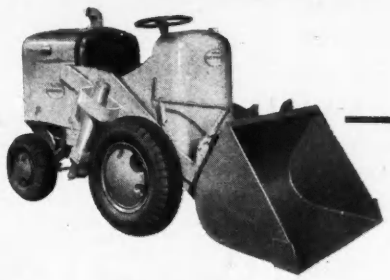
Established securely on this unique foundation of tradition and experience, the Flavel organisation of today is contributing to the Gas Industry new ideas and developments in the field of domestic cooking and heating appliances.

FLAVELS *of* LEAMINGTON

Established in the reign of King George III

For Coal Handling in GAS WORKS — use a Tractor





Another aid to faster, cheaper Handling

The "Payloader" Tractor Shovel

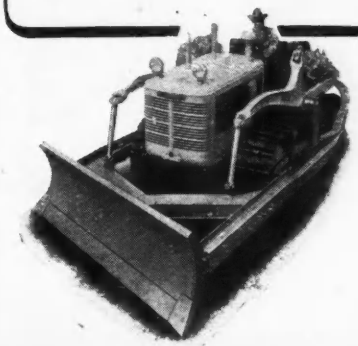
This sturdy, compact unit with the easy-loading, hydraulic shovel is very speedy and manœuvrable, and a great labour saver. It is a very valuable equipment for short haulage of coal, coke, ashes, etc., in gas undertakings.

It Loads, it Carries, it Dumps

HERE'S WHY

- A tractor loads on to your conveyor belt from any part of your stock pile.
- Its weight consolidates coa lstocks and minimises the chance of spontaneous combustion.
- A tractor makes any coal handling problem easy where mobile power is required.

We should be pleased to advise you on any coal handling problem.



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RUSTON-BUCYRUS BULLDOZERS & BULLGRADERS

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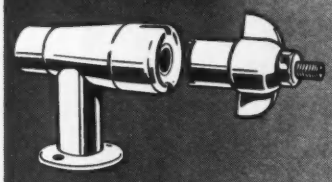
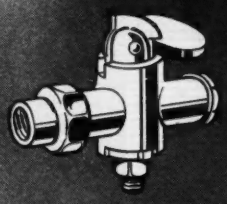
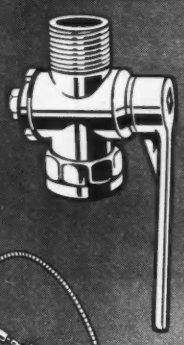
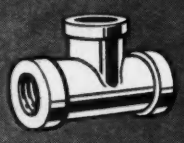
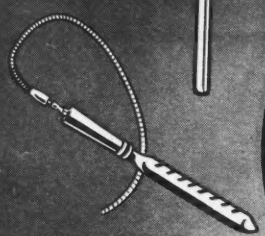
Contributing to the efficiency of GAS

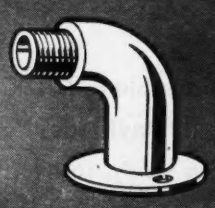












More than half a century's specialised experience is built into all Gas Fittings and Lighting Equipment supplied by Edgar's of Hammersmith. The high reputation they enjoy today among leading engineers throughout the Gas Industry, is due in no small measure to the supreme quality of materials used, and the rigid standards of workmanship and inspection employed at every stage of manufacture.

EDGAR

Gas Fittings & Apparatus

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Flexible Plugs and Sockets, Main Cocks, Union Cocks, Equal Tees, Flanged Elbows, etc., etc., made to B.S. Specification and available in a complete range to meet all requirements. Complete Street Lighting Equipment. Gas, Hot Water and Central Heating Installations. Full details furnished on request.

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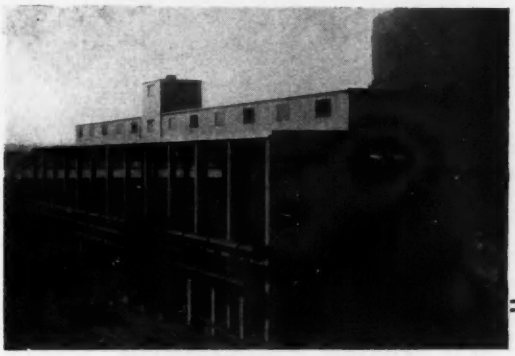
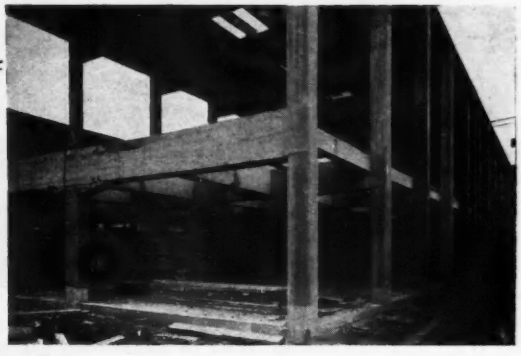
SPECIALISTS IN REINFORCED CONCRETE FOUNDATIONS & STRUCTURES FOR THE GAS INDUSTRY



PURIFIER HOUSE AT SOUTHAMPTON GASWORKS CONSTRUCTED IN 1937

PART OF DUPLICATE PURIFIER HOUSE AT SOUTHAMPTON UNDER CONSTRUCTION 1948



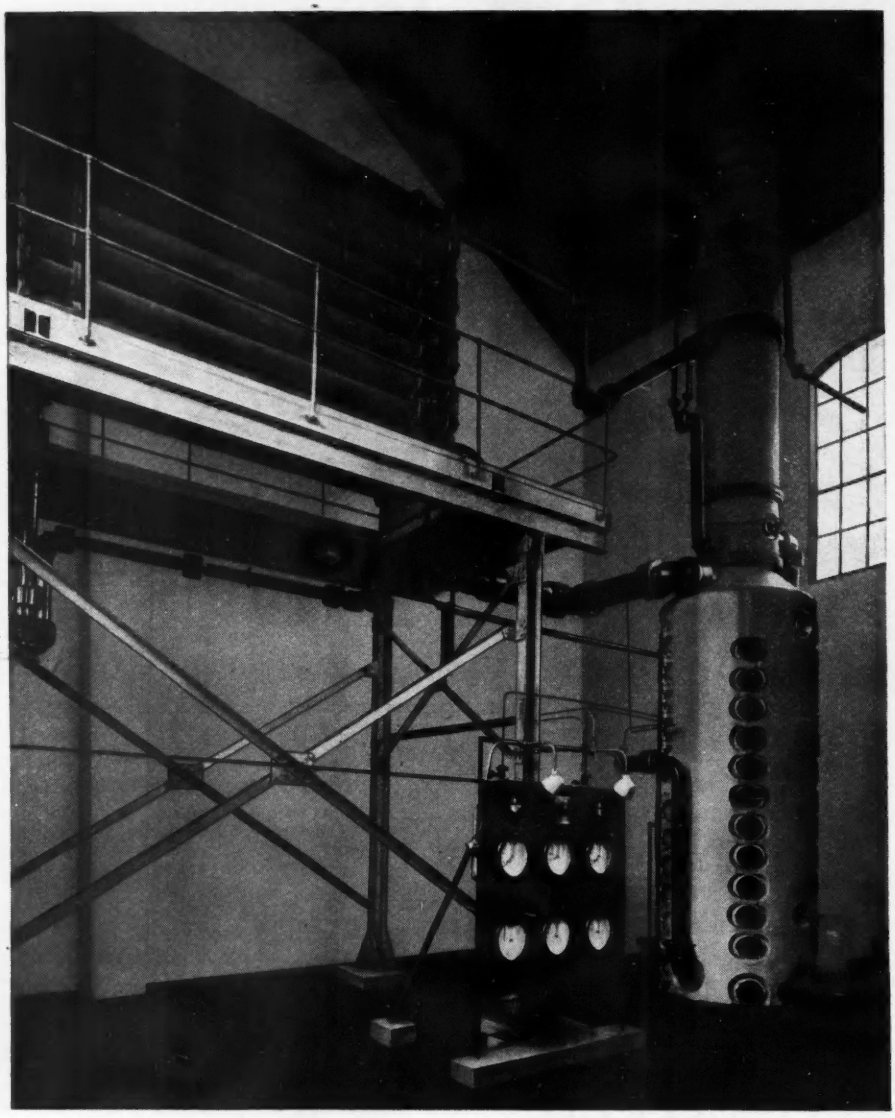
OUR LONG AND VARIED EXPERIENCE ENSURES SATISFACTION

F. C. CONSTRUCTION Co LTD

DESIGNERS & CONTRACTORS

CITY ROAD DERBY

TELEPHONE: DERBY 45424



Many years of experience are behind this Wilton Plant.

Weak ammonia liquor is converted into concentrated liquor of any desired strength up to 25%.

In doing this, all the ammonia goes into the product. Nothing is returned to the well.

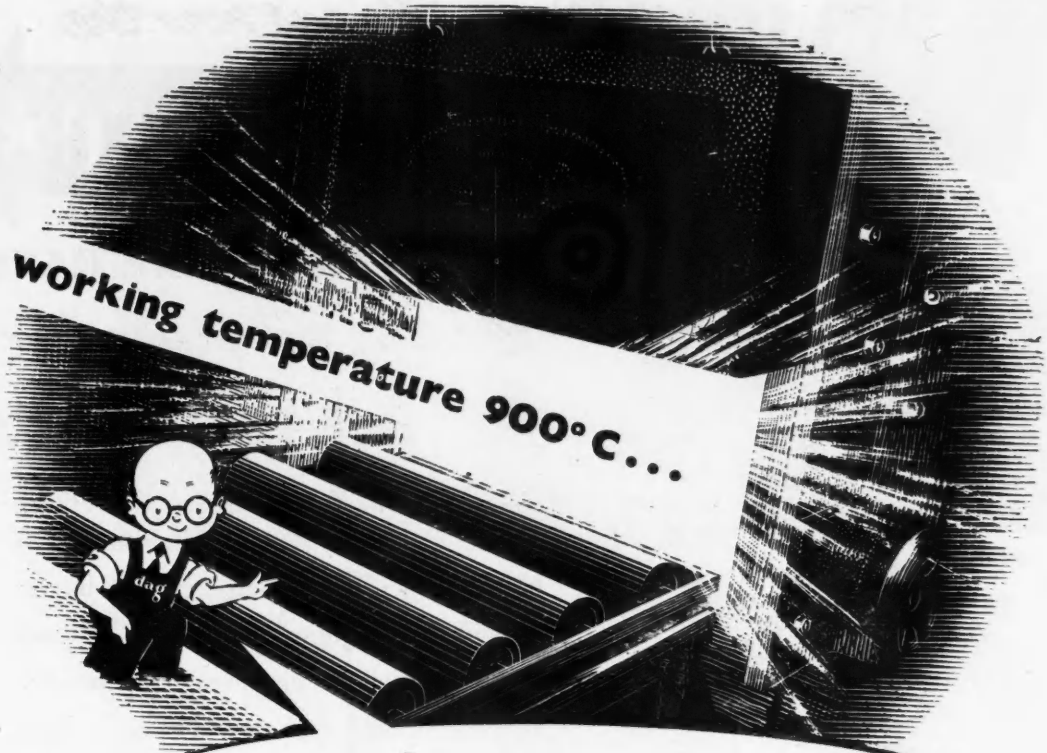
Don't waste it! It has as much nitrogen as an equal weight of sulphate.

The " Cost of Manufacture " will gladly be sent on application to :

THE CHEMICAL ENGINEERING & WILTON'S PATENT FURNACE CO., LTD.

HORSHAM - - - - SUSSEX

TELEGRAMS : EVAPORATOR, HORSHAM. TELEPHONE : HORSHAM 965.



...but the conveyor runs freely!

How to keep the conveyors of furnaces, ovens and other equipment freely lubricated at temperatures at which oils burn off is a problem solved by 'dag' colloidal graphite. Available in a variety of liquids, it is easy to apply and stays on the job unaffected by high temperatures. Maybe you don't operate a mechanical furnace, but you do have your own particular problems of high temperature lubrication. Send off the coupon below to Acheson Colloids Limited, 9 Gayfere Street, Westminster, London, S.W.1, and learn how they can be solved by 'dag' colloidal graphite.

The problem is solved by

dag COLLOIDAL GRAPHITE

Graphite at its finest!

CUT OUT and MAIL TO-DAY

One of the dag COLLOIDS

To: Acheson Colloids Limited, 9 Gayfere Street, Westminster, London, S.W.1.

Please send Leaflet 63 and other information on High Temperature Lubrication with 'dag' Colloidal Graphite.

Name..... **Position in Firm**.....

Address.....

This is how the

Daleware★

KITCHENWARE RANGE

is being advertised to your customers this year!

It is helping the extremely high quality of the Daleware Range to become even better known to the better class of buyer. It will bring these people up to your counter. Sell them one article from the Daleware Range and they will come back for more.

Daleware sets the standard by which the best kitchenware is judged. And it has always been honestly advertised. All Daleware is now Mirror-finished outside.

The

Daleware★

Range

KITCHENWARE

Round and square saucepans — Round and square casseroles — Milk Saucepans — Frying pans, round (large and small) and oval — Porringers — Girdle Plates — Tankards — Kettles — Sinks.

THE DALEWARE KITCHEN COOKERY BOOK — *Planning and equipping the kitchen along modern lines: cooking hints and many recipes by Phyllis Garbutt. 36 pages packed with information. 1/3d. post free.*

NEW ERA DOMESTIC PRODUCTS LTD

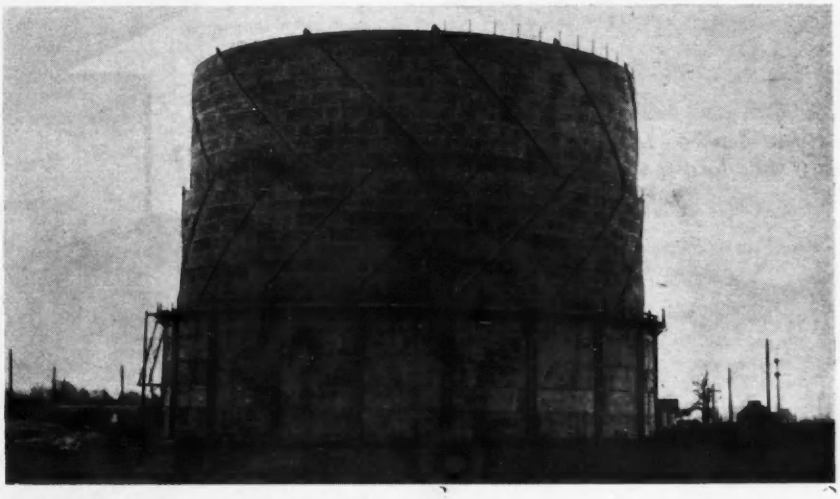
Head Office and Showrooms: 105, Baker Street, W.1

Telephone: Welbeck 2525

D54

REVERSION

Skip's ancestors, for many generations, were the recognised colour of his breed,—black. Puppies born with him were, all black. Mendelism teaches that any progeny of Skip's and another of his breed,—would be black. That is,—there would be REVERSION towards past conditions. Skip is known in many gas-works between the Isle of Wight and the North of Scotland.



Specification for this (unfinished when photographed) gasholder was considerably altered by us and reluctantly accepted by the Makers. Method of riveting and details of design, also manner of testing when completed. So successful were results, to all concerned, that all these improved methods will be treated as Evolutionary and there will be NO REVERSION.

"Not a fault was found, nor an ominous note,
As the lifts went upwards unhurried,
Not a Manager growled a rude retort,
Nor bubbles innumerable scurried."

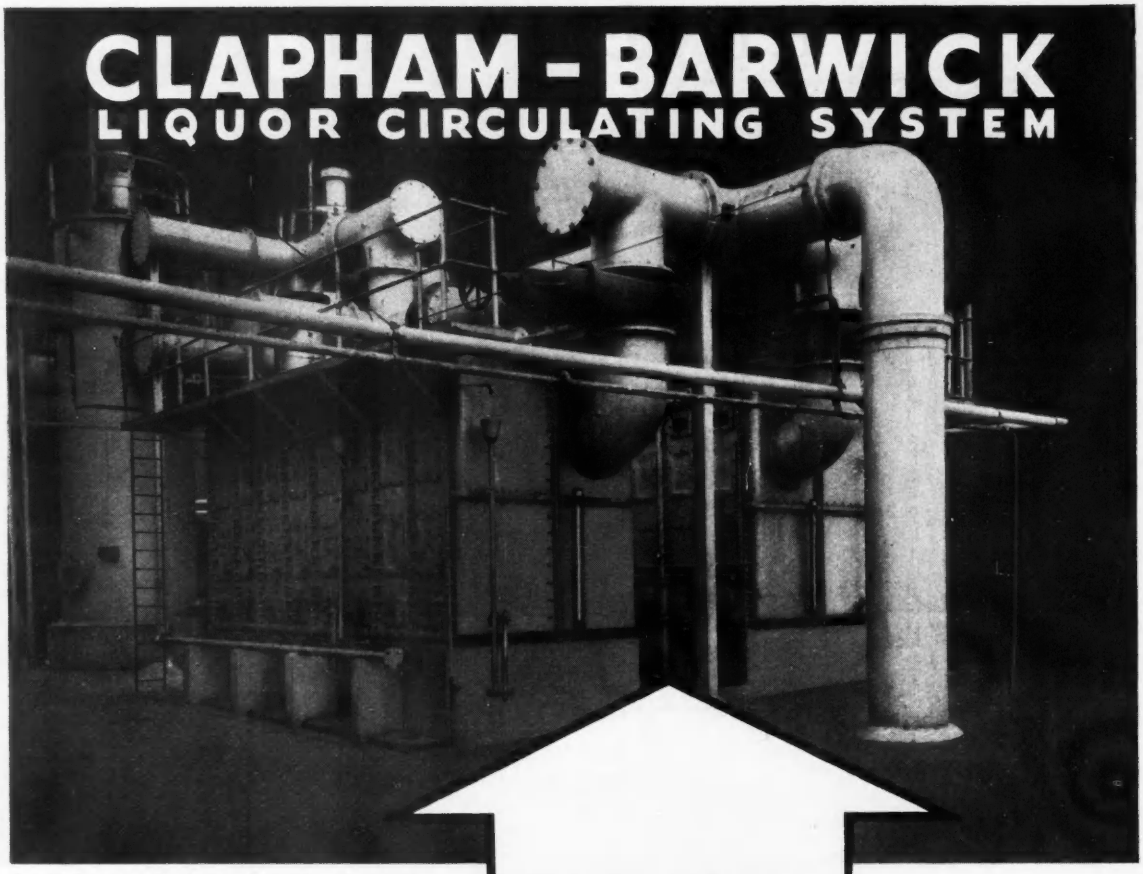
LEONARD BOTT Limited

GASHOLDER INSPECTORS

15, Holyhead Road ('Phone 320) WELLINGTON, Salop

EVOLUTION

CLAPHAM-BARWICK
LIQUOR CIRCULATING SYSTEM



Installed at Athol Street Gasworks, Liverpool. (photograph by courtesy of the Liverpool Gas Co.)

PUMPLESS!

Instead, this trouble-free compressor gives these definite advantages . . .

Maintenance of mechanically operated parts eliminated, there are no moving parts in contact with liquid. Liquid is circulated by compressed gas, which is returned to the gas stream. The small compressor—the only mechanism—can be located in the exhauster house. All sizes (0.2 mill. to 8 mill. cubic feet per day) for ammonia, benzol, etc.

CLAPHAM BROS. LIMITED

MAKERS OF GAS WORKS EQUIPMENT SINCE 1837

KEIGHLEY-YORKS - Tel: 2787-2788 - Grams: "Clapham Bros., Keighley."

BRITISH **GF** MADE

MALLEABLE TUBE FITTINGS

having perfect threads and real malleability are reliable for

GAS, WATER, STEAM, OIL AND AIR

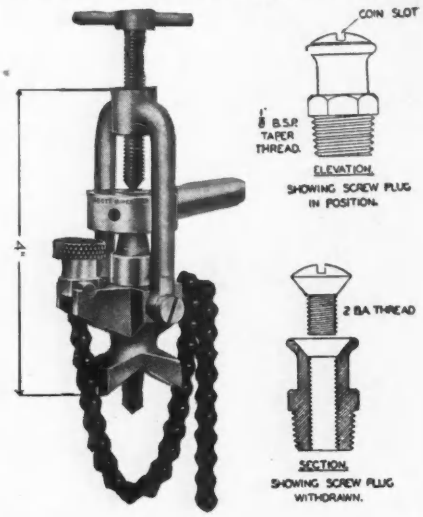
Over 100 million c. ft. of BEDFORD Town Gas is used annually to make GF Fittings

LE BAS TUBE CO. LTD.

RIVER PLATE HOUSE
12 & 13 SOUTH PLACE, LONDON, E.C.2.

A FEW "ABBIRKO" SPECIALITIES FOR PROMPT DELIVERY

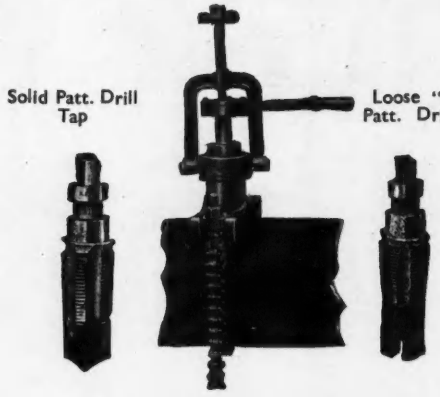
"ABBIRKO" MINIATURE RATCHET DRILLING AND TAPPING MACHINE



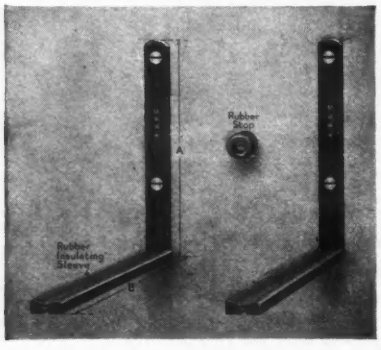
DRILLS AND TAPS, ¼" to 4" W.I. TUBES

For inserting Pressure Testing Nipples (as illustration) or taking off *Branches* ¼" to ⅜" *B.S.P.* Saves expensive cutting out and insertion of Tees.

"ABBIRKO" CENTRAL ACTION DRILL STANDS AND EQUIPMENT



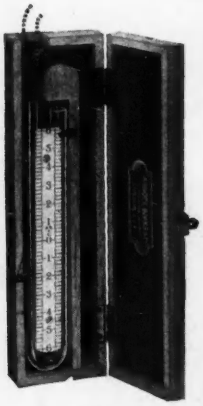
No. 3 size, ½" to 2".
For accurately Drilling and Tapping Gas and Water Mains.



GL84 GAS METER BRACKETS

Showing Rubber Sleeves and Stop in position.
Electrically Insulated: supplied in five sizes.

SHORT'S SURFACE GAS LEAK INDICATORS



Patt. No. 189.

POCKET PRESSURE GAUGE IN WOOD CASE.

Ranges 6", 9", 12" and 18".

No. 40. "ABBIRKO" POCKET BUBBLE LEAK TESTER

Fitted with I.R. Ball Pump. Instantly detects the smallest leak throughout any internal pipe system.

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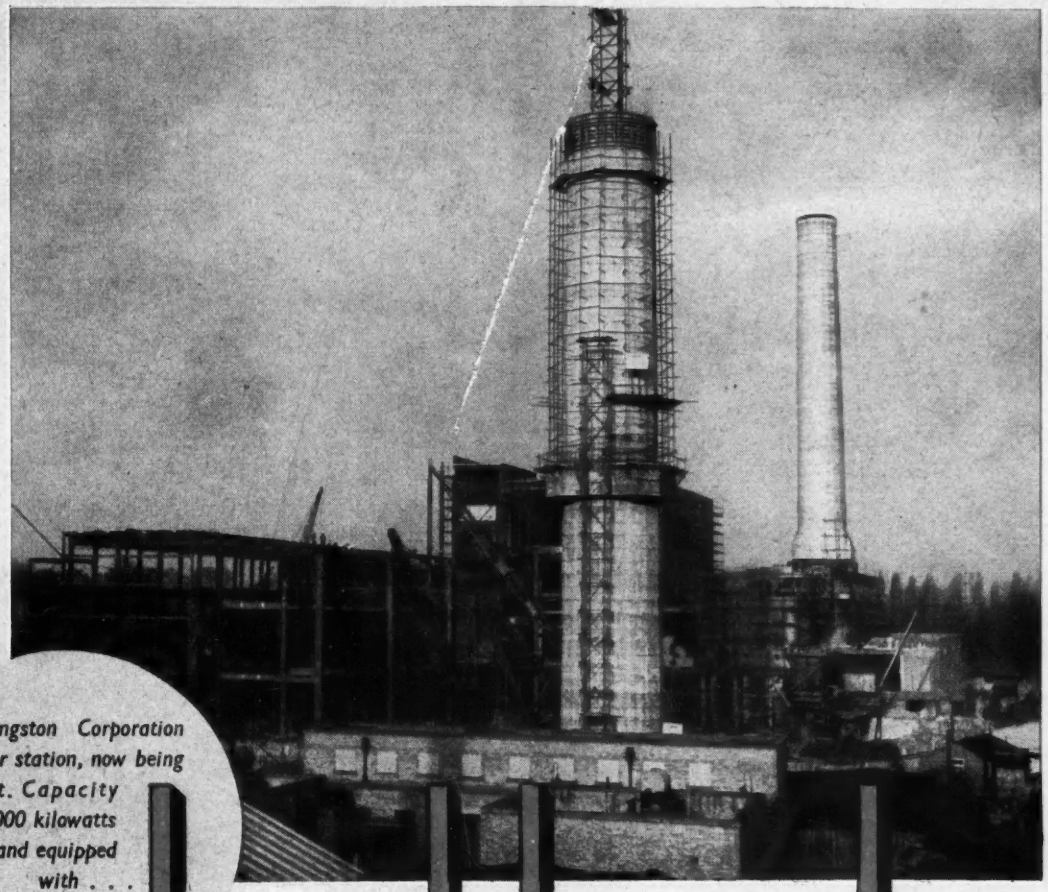
Phone: Waterloo 4066 (4 lines) Works and Warehouses: Blackfriars Rd. and Ufford St. 'Grams: Abbirko, Sedist, London



Kingston Corporation power station, now being built. Capacity 120,000 kilowatts and equipped with . . .

Photograph by courtesy of the "Times"

Lockheed

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INDUSTRIAL HYDRAULICS

FULLY LOCKHEED PATENTED

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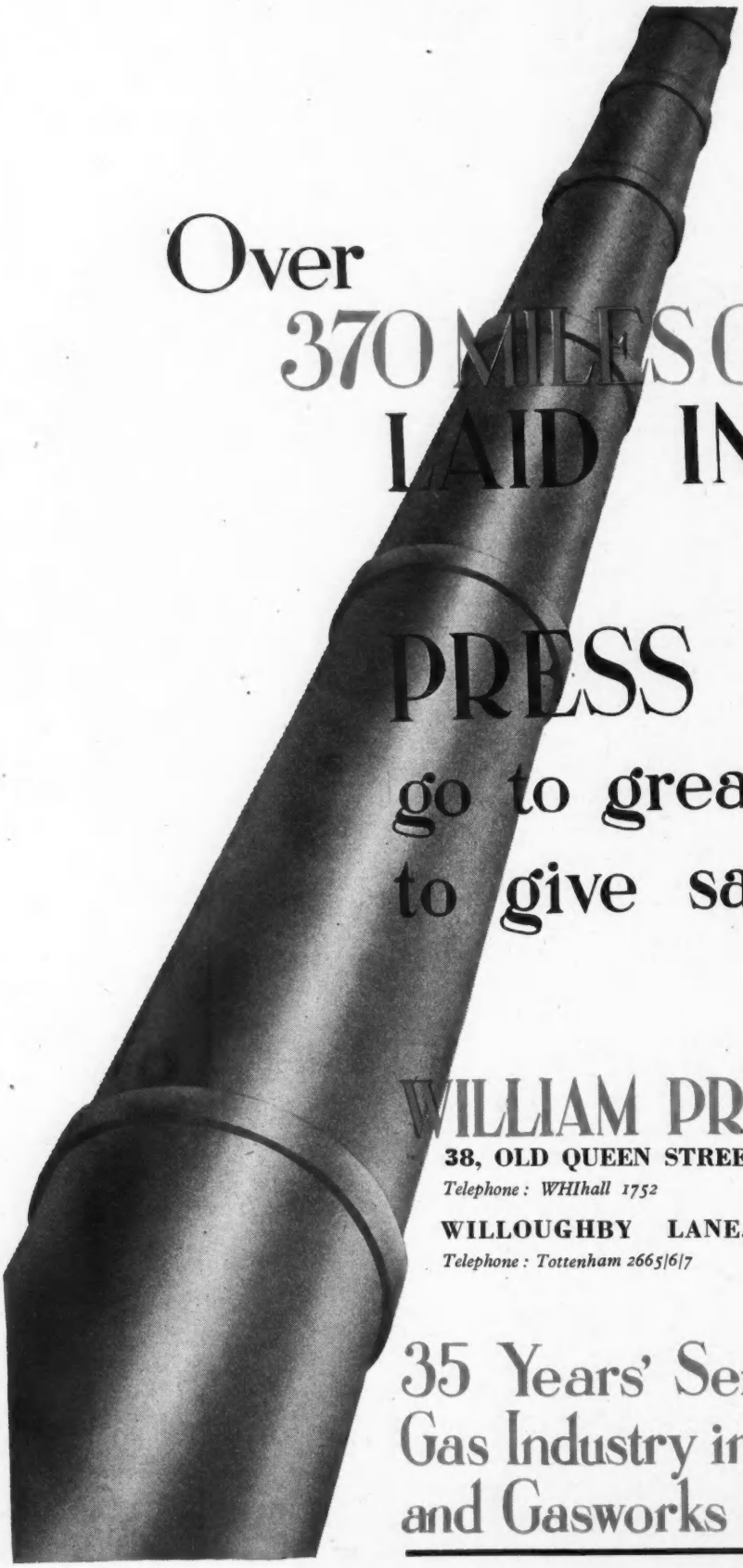

Over
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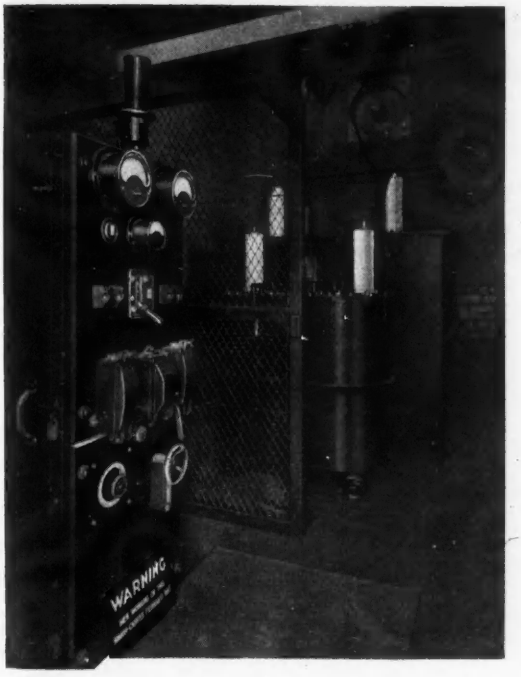
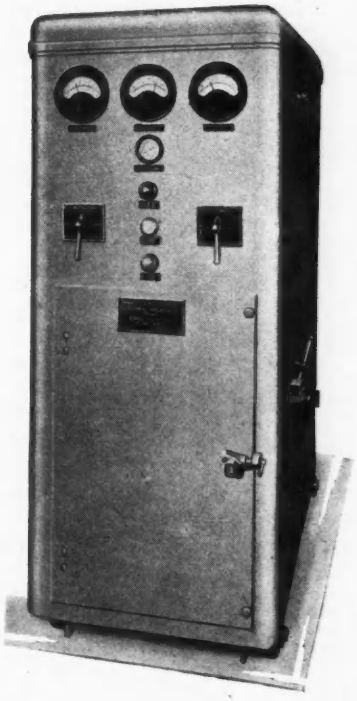


1928—Pioneers

View in rectifier house, showing cubicle and instrument panel, transformer and static rectifier of the pioneer Simon-Carves static rectifier H.T. equipment for electrostatic precipitation - the first of its kind in Great Britain.



1948—Leaders

Simon-Carves-Ferranti shock-proof static rectifier H.T. equipment, as used in modern precipitation plants. More than 75 of these sets have been ordered since their introduction.

The photograph shows a 33KV 60 m/a set.

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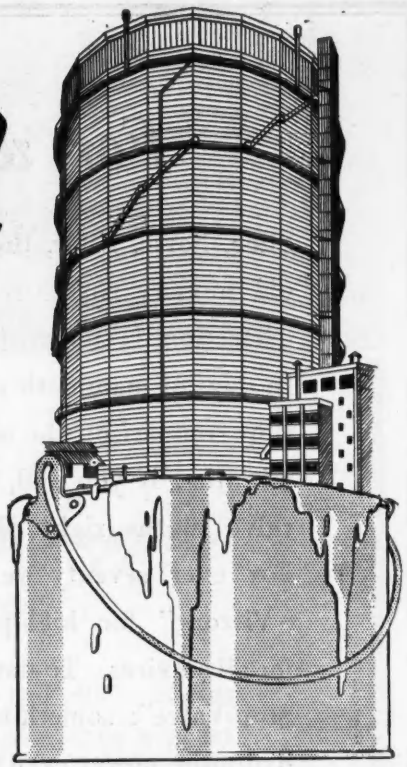

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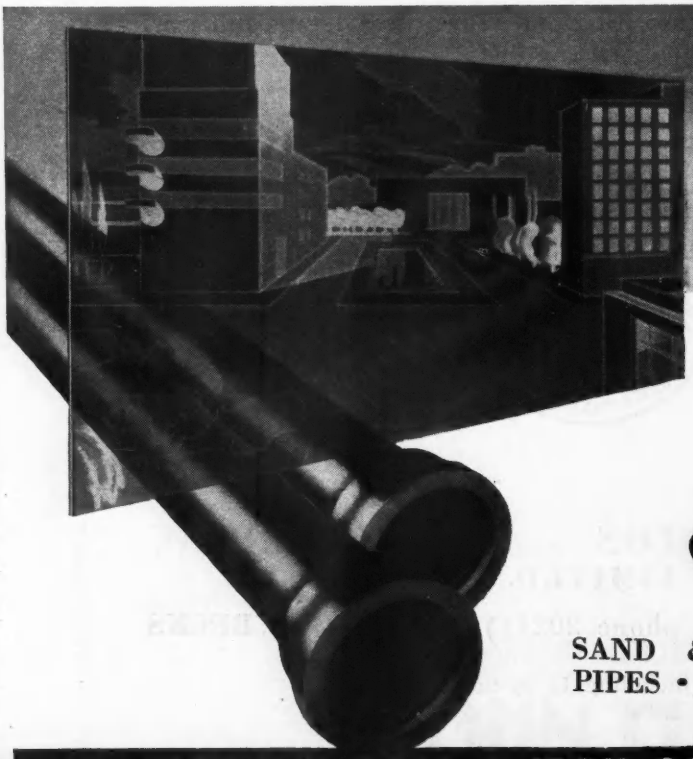

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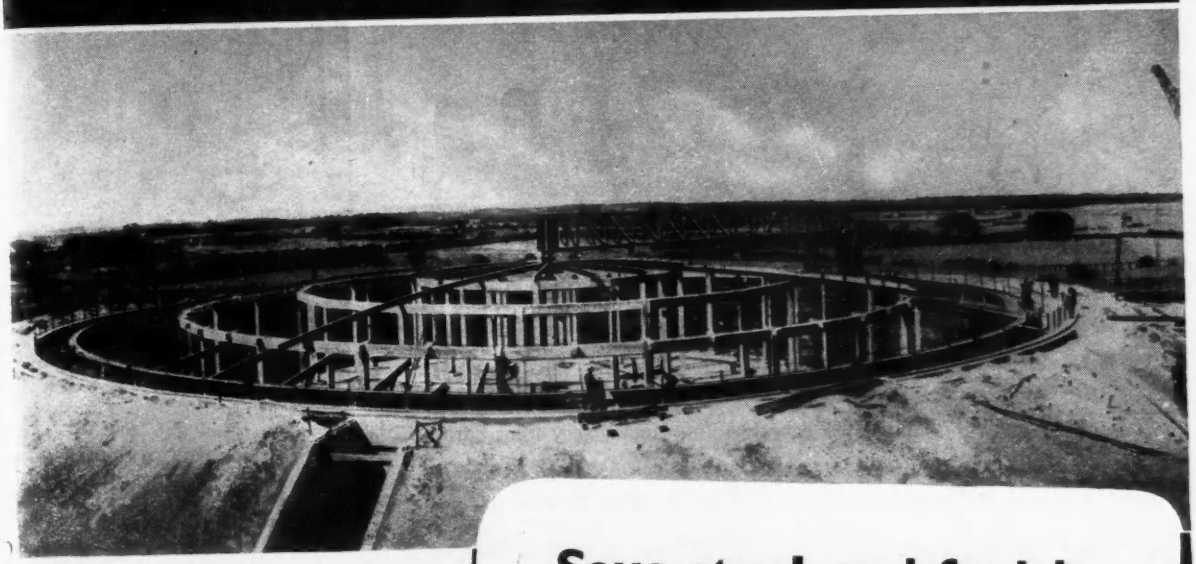

Illustration shows work in progress on construction of all-welded three-lift gasholder in underground reinforced concrete tank. Concrete tank: 216'-0" dia. × 31'-9" deep.

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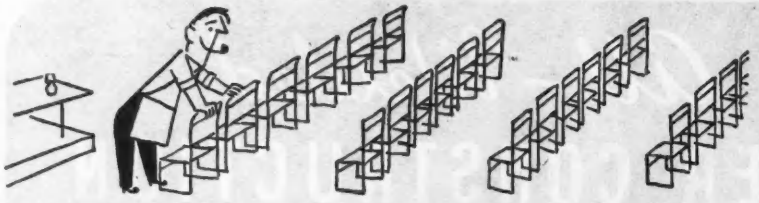

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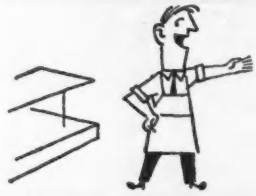
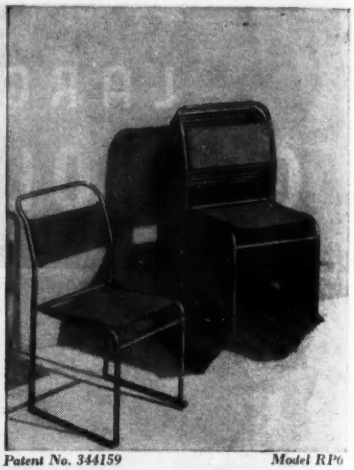


AND PERFECT STACKING WHERE SPACE IS LACKING



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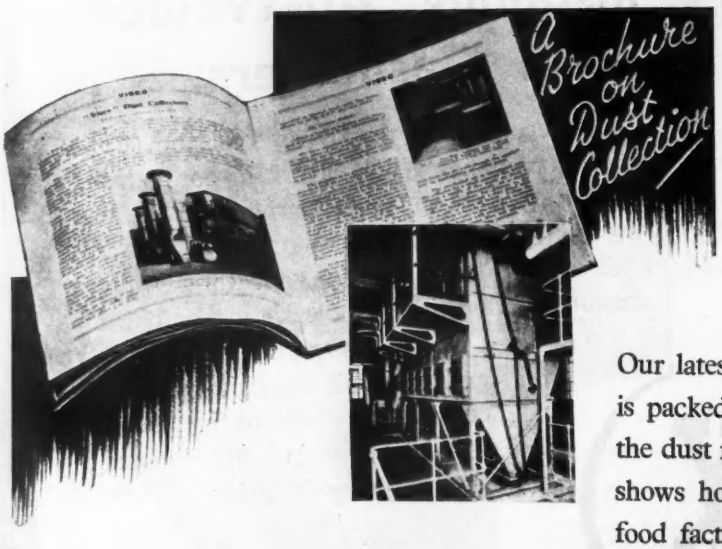

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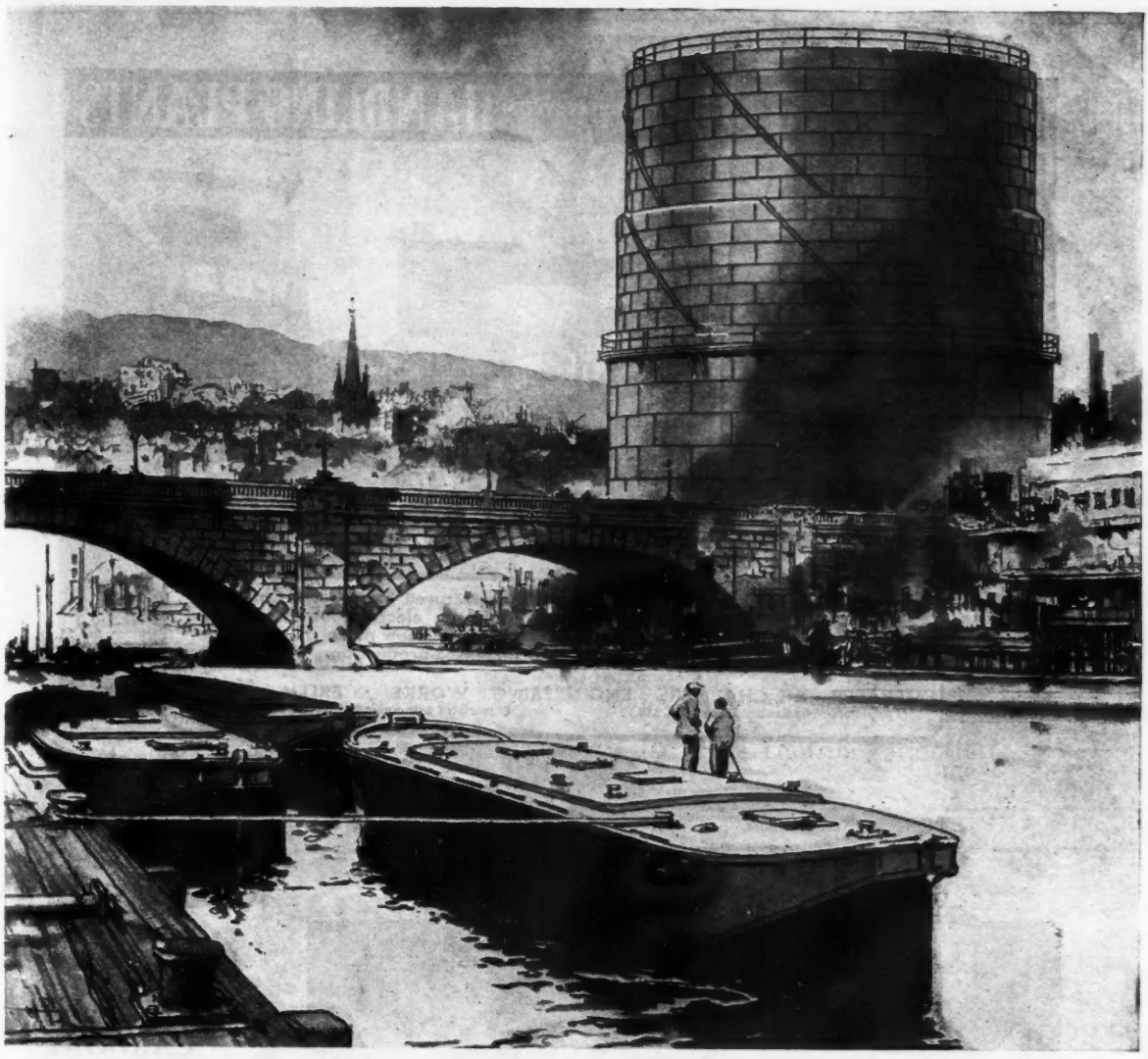

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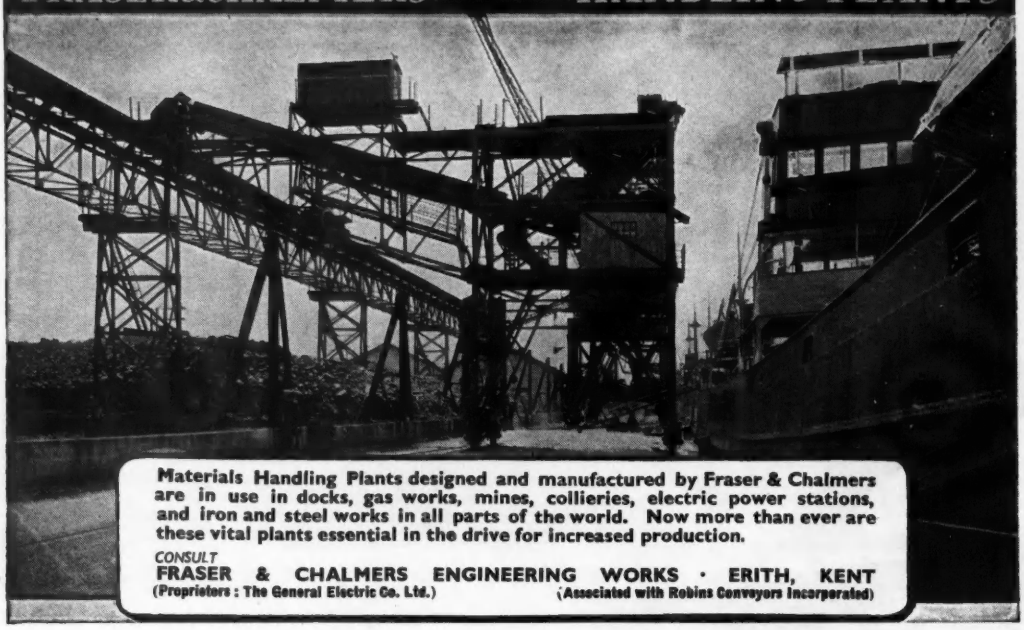

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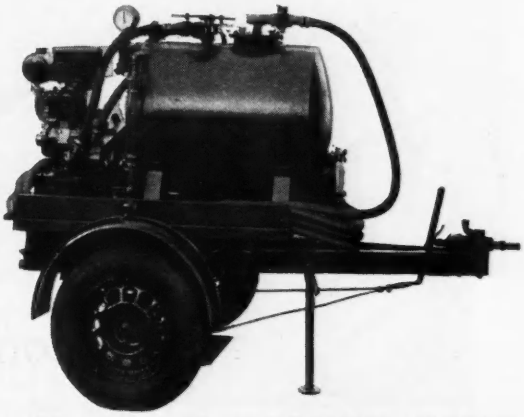

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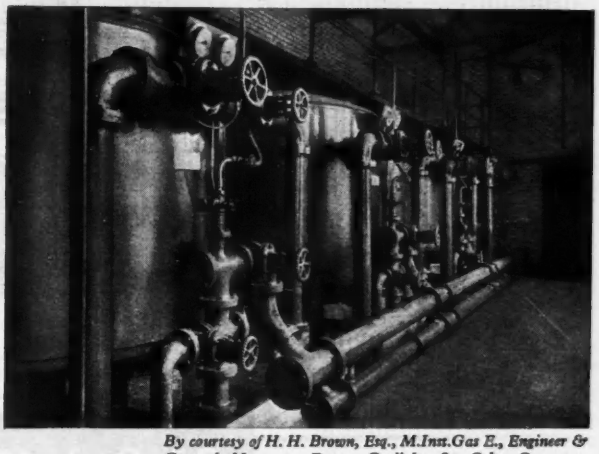

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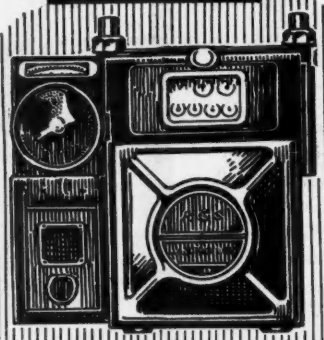

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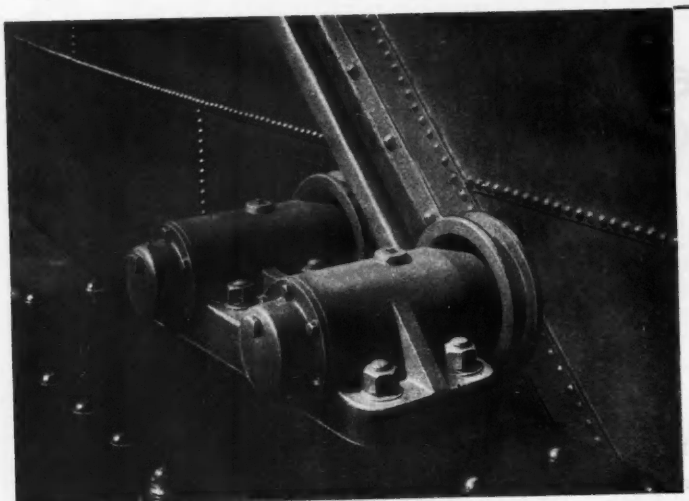

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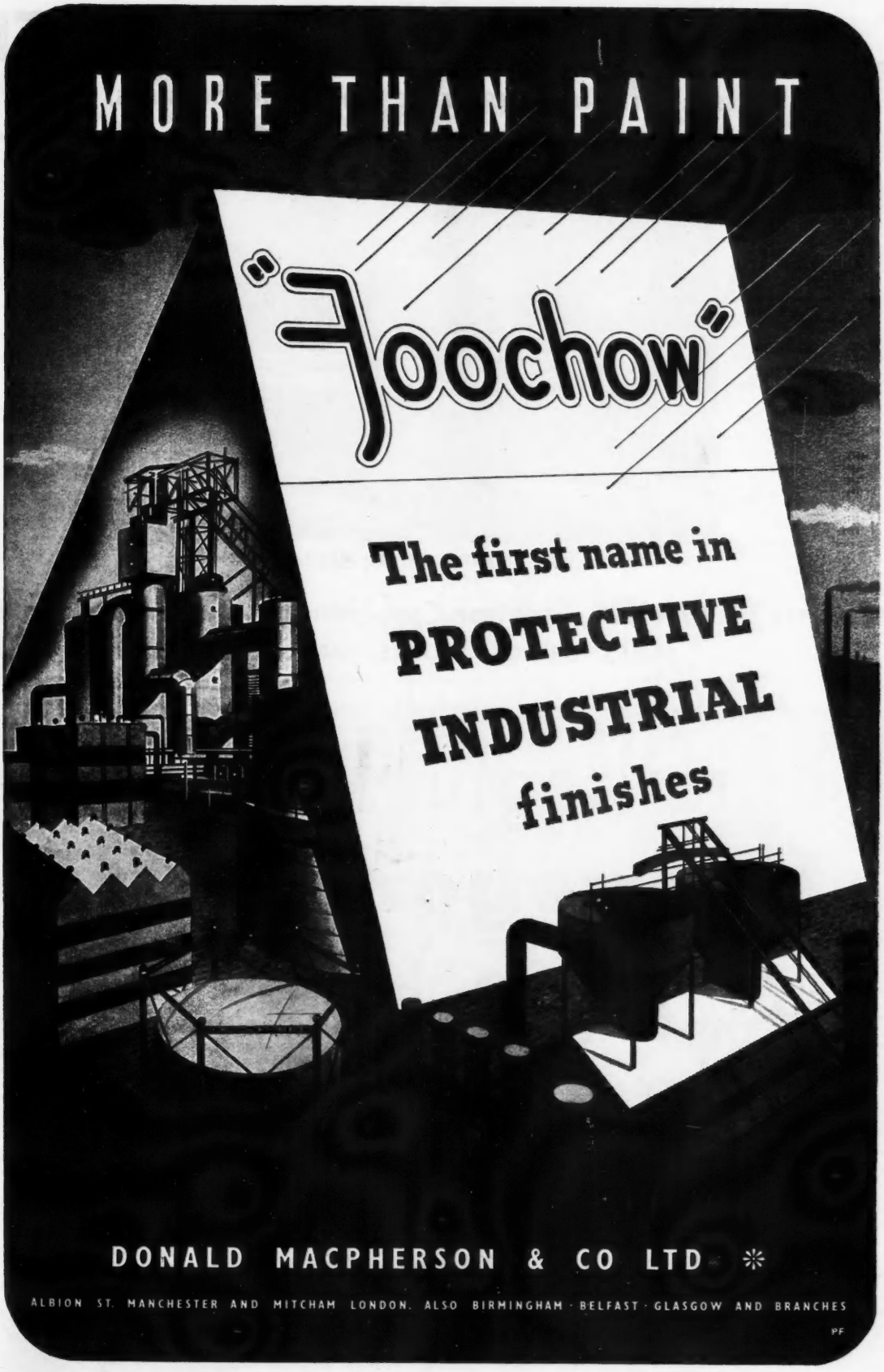
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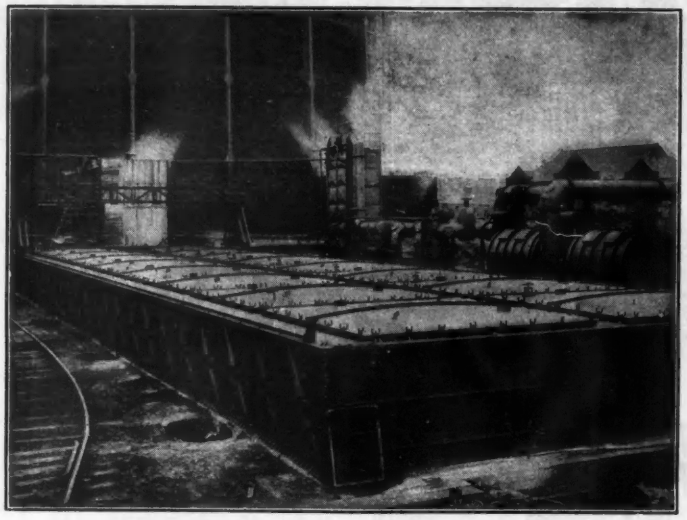

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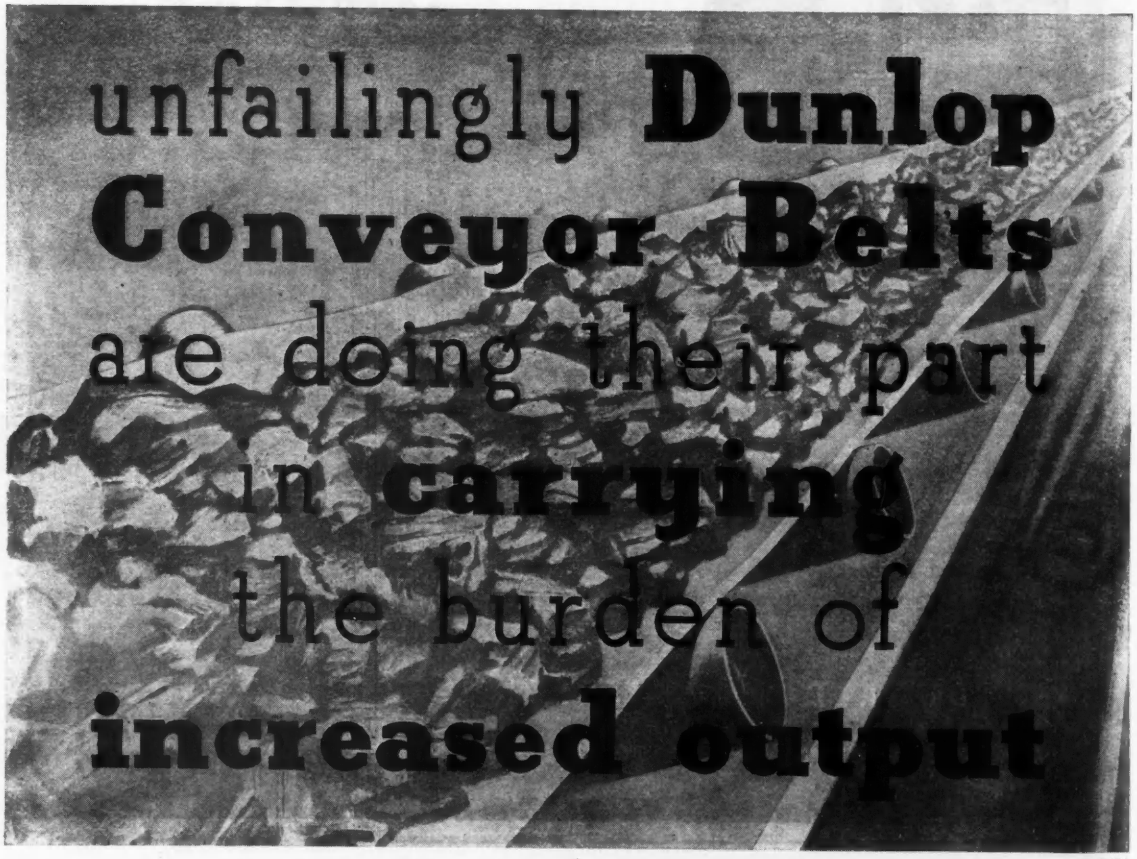

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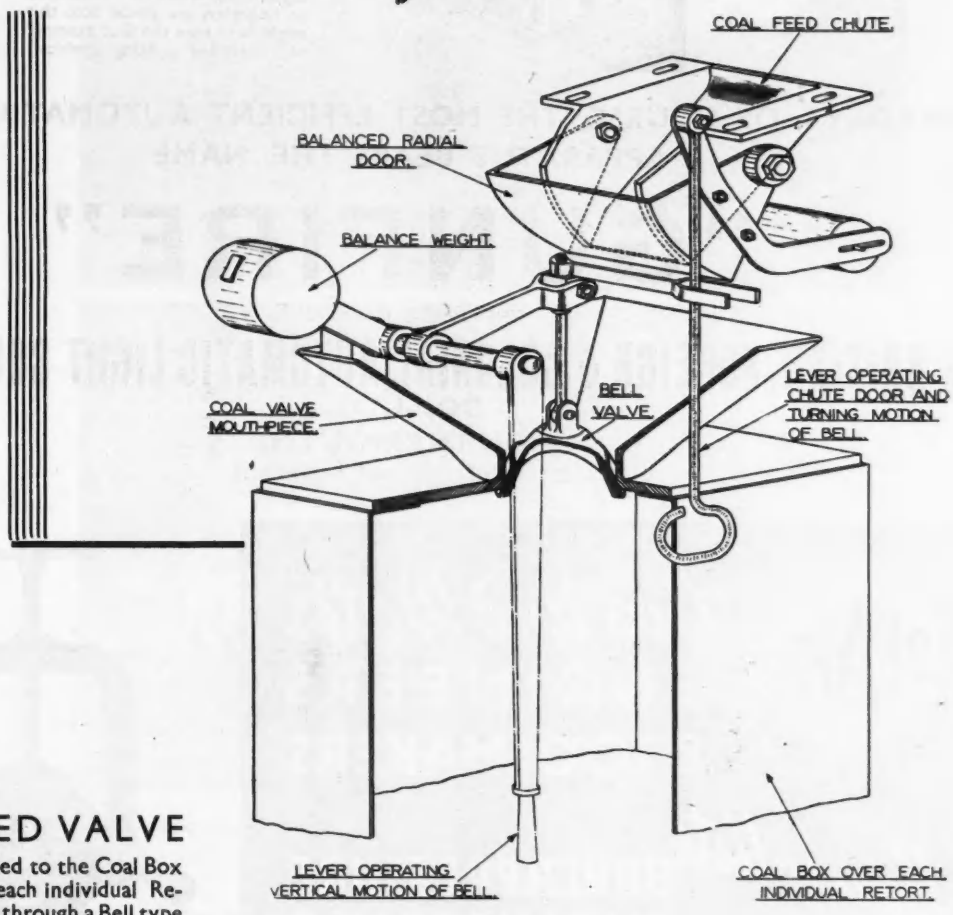
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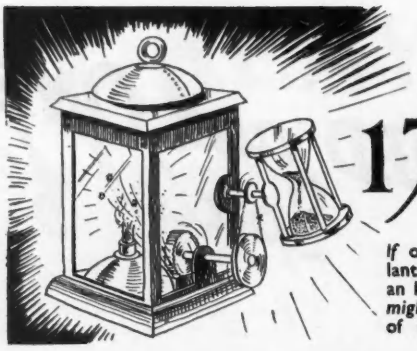

1769

If one John Box *had* invented a lantern to which was attached an hourglass and tinder box, this *might have been* the first example of controlled lighting ignition.

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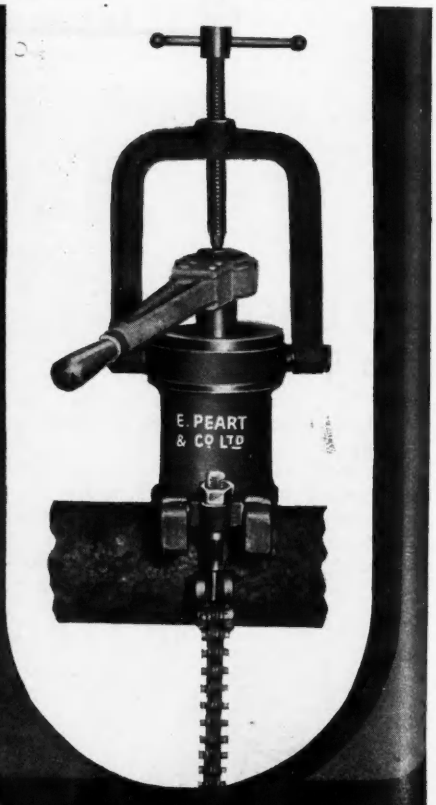

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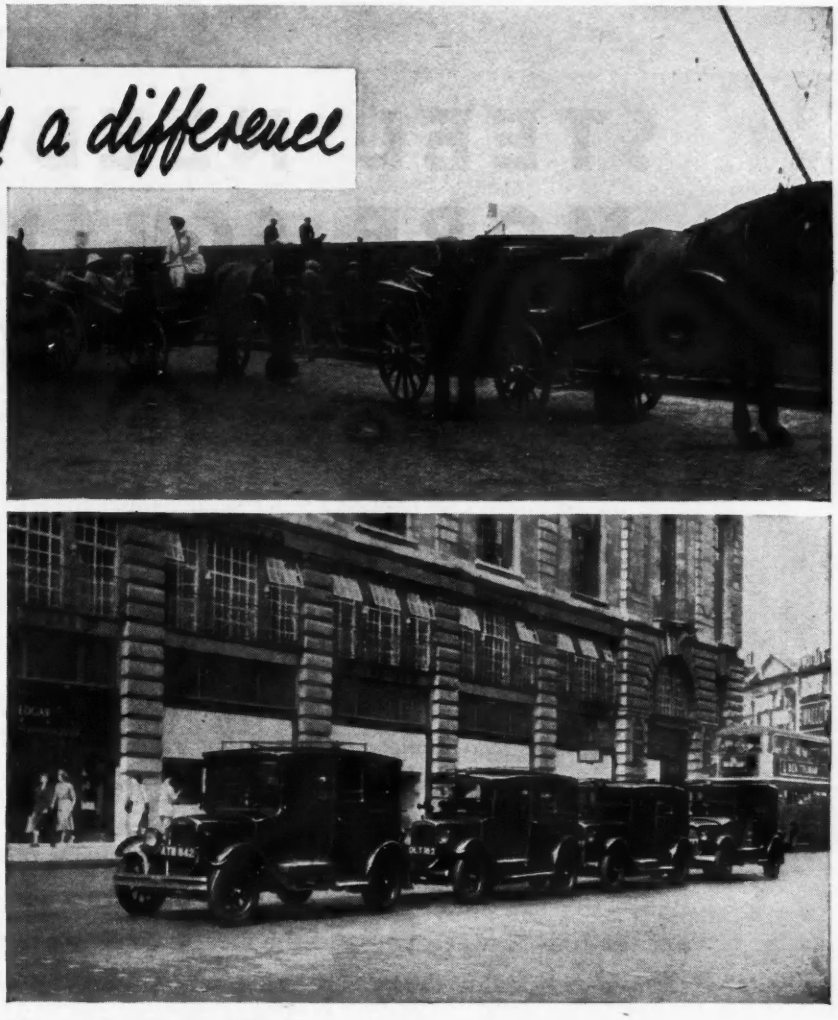

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The plain fact is we have got to help ourselves.

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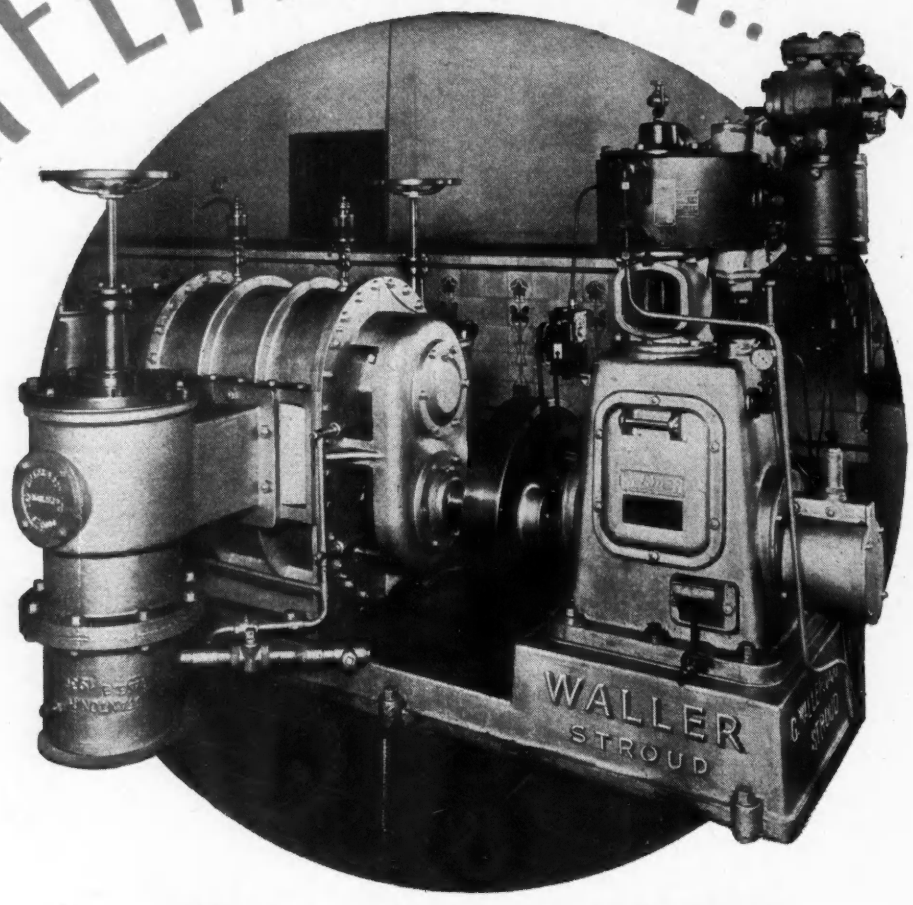

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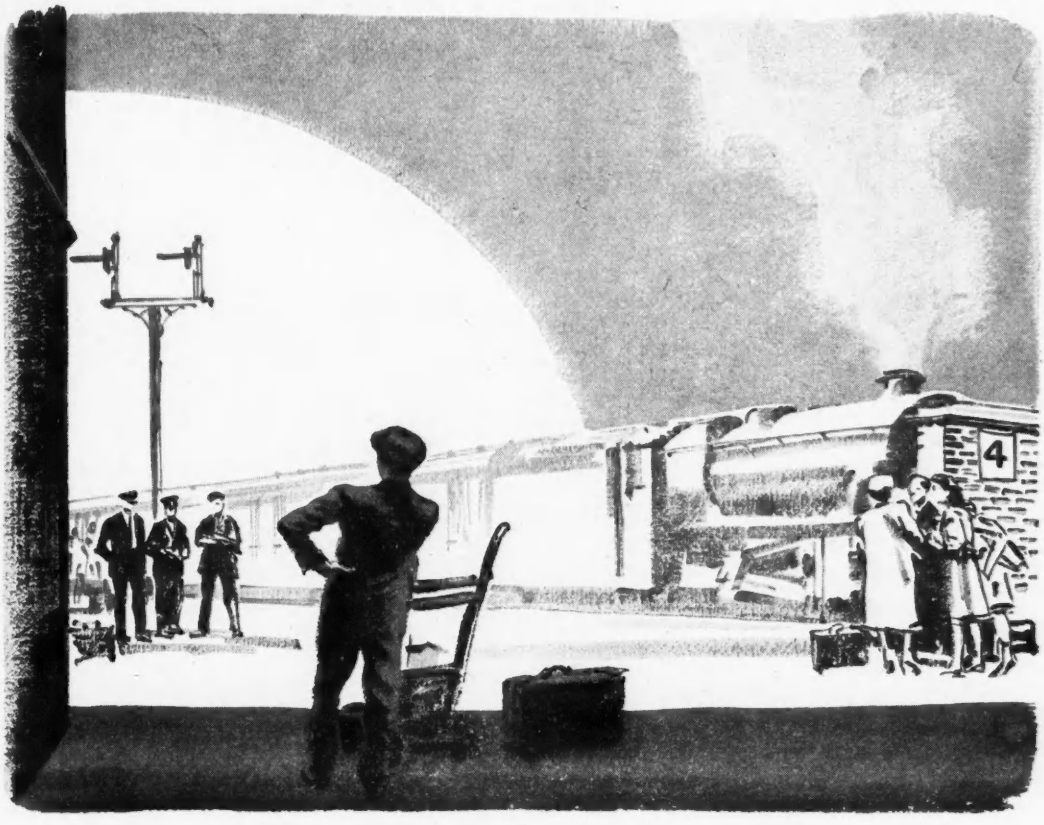

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THE STEEL TUBE AGE

S & L TUBES ON THE RAILWAYS

Many engineers, on seeing the Stewarts and Lloyds film 'The Tube Age', have expressed interest in the uses of steel tubing outside their own range of activities. This advertisement is one of a series illustrating some of the many specialised applications of S & L steel tubes, with which many of our readers may already be familiar.

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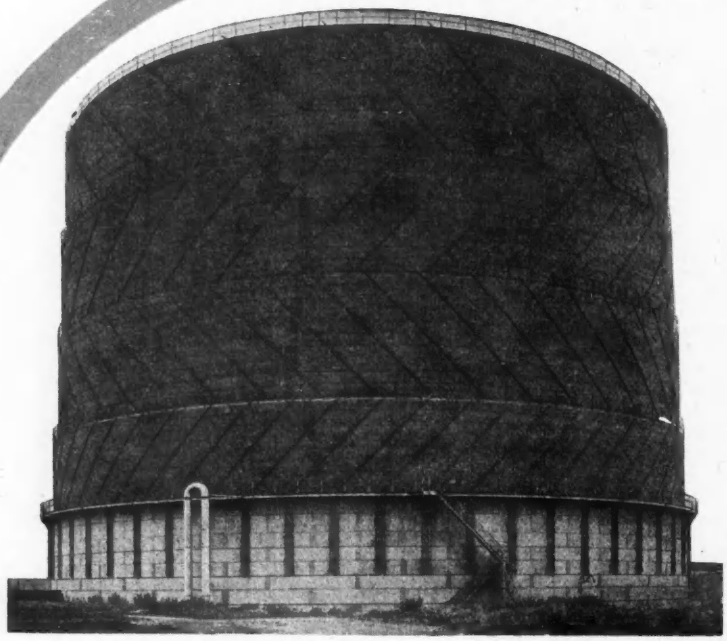
80 YEARS' EXPERIENCE
OF EVERY TYPE OF GASHOLDER



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It has successfully withstood the **TEST** of time, and can be CONFIDENTLY relied upon for **ACCURACY** and trouble-free recordings. The continuous **RECORD** can be duplicated at any desired remote point.

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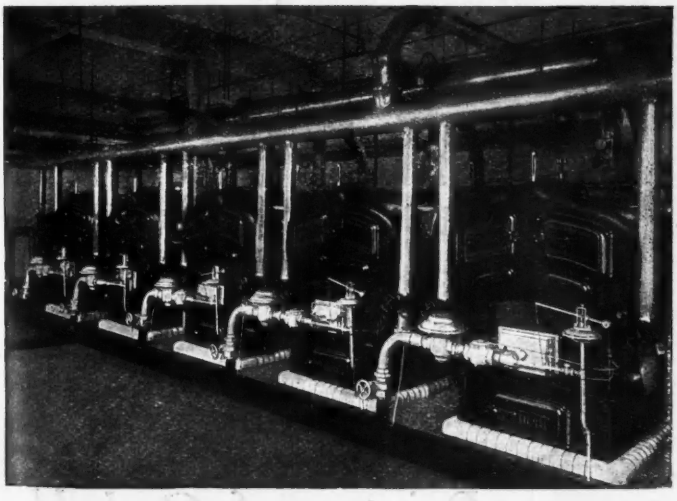

GROUP OF FIVE NO. 12 M. MAJOR ROBIN HOOD BOILERS CONVERTED TO GAS FIRING, USING OUR IMPROVED RADIANT BURNER, AND FITTED WITH OUR AUTOMATIC AIR LOUVRE CONTROL AND THERMOSTATIC GAS CONTROL

Heat with Gas and Save Labour Costs

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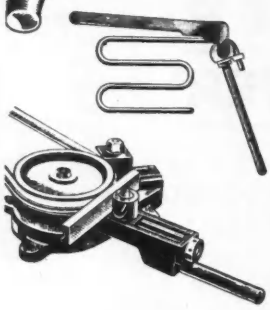
6 TUBE AND BAR BENDERS THAT BEND COLD AND UNLOADED

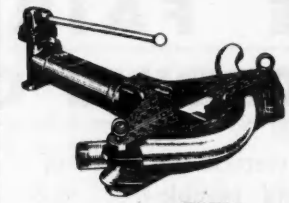


STAFFA *QUICKSET BENDER*

Each Bender is a self-contained unit small and light enough to be carried in the tool bag and ideal for bending tubing which has already been partially connected. Suitable for the Plumber, Sanitary Engineer and Coppersmith. Made for ¼ in., ⅜ in., and ½ in. I.D. and ⅜ in. O.D. tubing.

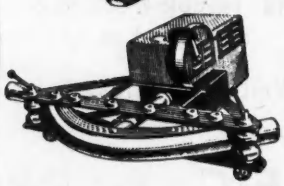
STAFFA *PRECISION BENDER*

Specially designed for bending of Light Gauge and Copper tubing from ⅜ in. to 1¼ in. dia. through angles as great as 180°. With additional formers, Gas tubes, Rounds, Flats and Squares can also be handled.



STAFFA *2-STAGE PORTABLE OIL HYDRAULIC BENDER*

This machine with attachments bends :—Steam and gas tubes ⅜ in. up to 3 in. nom. bore. Conduits up to 2 in. O.D. Flat bars up to 4 in. x ½ in.



STAFFA *4" MOTORISED BENDER*

A portable machine which bends tubes cold and unloaded up to 4 ins. steam, quickly and efficiently. 3-way control. Suitable for 220/1/50 electric supply. 'Take off' arms are provided so that the tube is automatically ejected.

Staffa PRODUCTS

STAFFA *HANDIMAN BENDER*

A cheaper type of bench mounted machine for jobbing and building work. Bends Rounds up to ⅜ in., Flat bars up to 1 in. by ⅛ in., Conduits up to 1 in. O.D. (Min. 16 S.W.G.), Steam and Gas tubes up to ¾ in. nom. bore.

STAFFA *SMALRAD BENDER*

Is of mandrel type, and tackles small radius bends up to 1 in. tube. Provides precision bends with throat radi equal to twice tube diameter.

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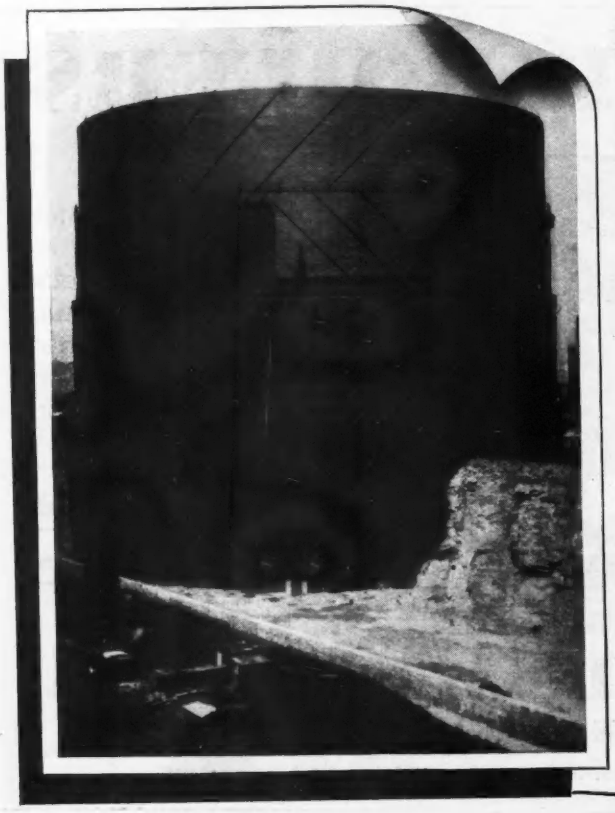

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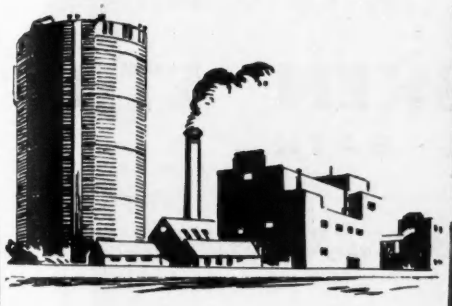
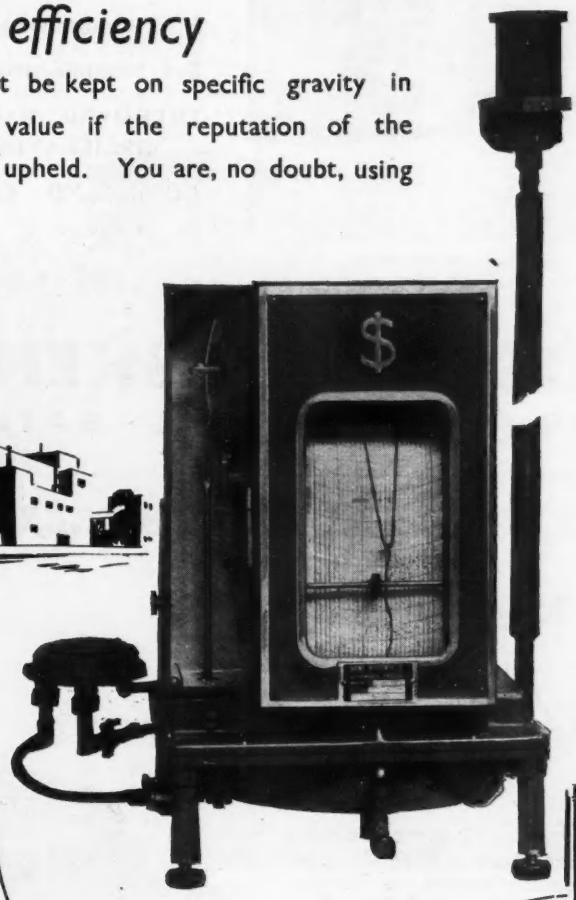
SPECIFIC GRAVITY RECORDER

For accuracy, long trouble-free service and efficiency

A close check must be kept on specific gravity in addition to calorific value if the reputation of the Gas Industry is to be upheld. You are, no doubt, using Sigma Calorimeters!





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SIGMA INSTRUMENT CO. LTD.

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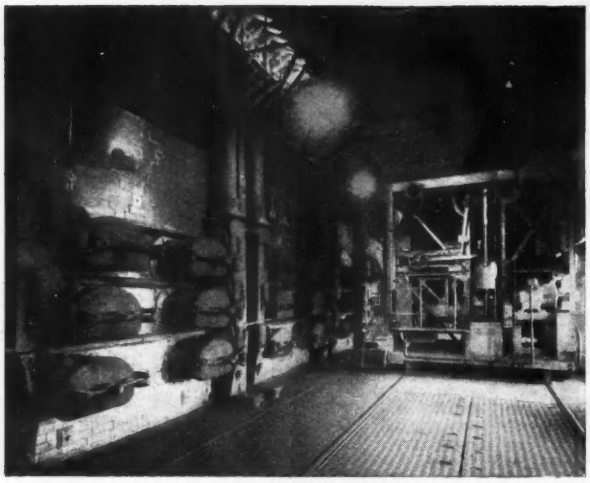

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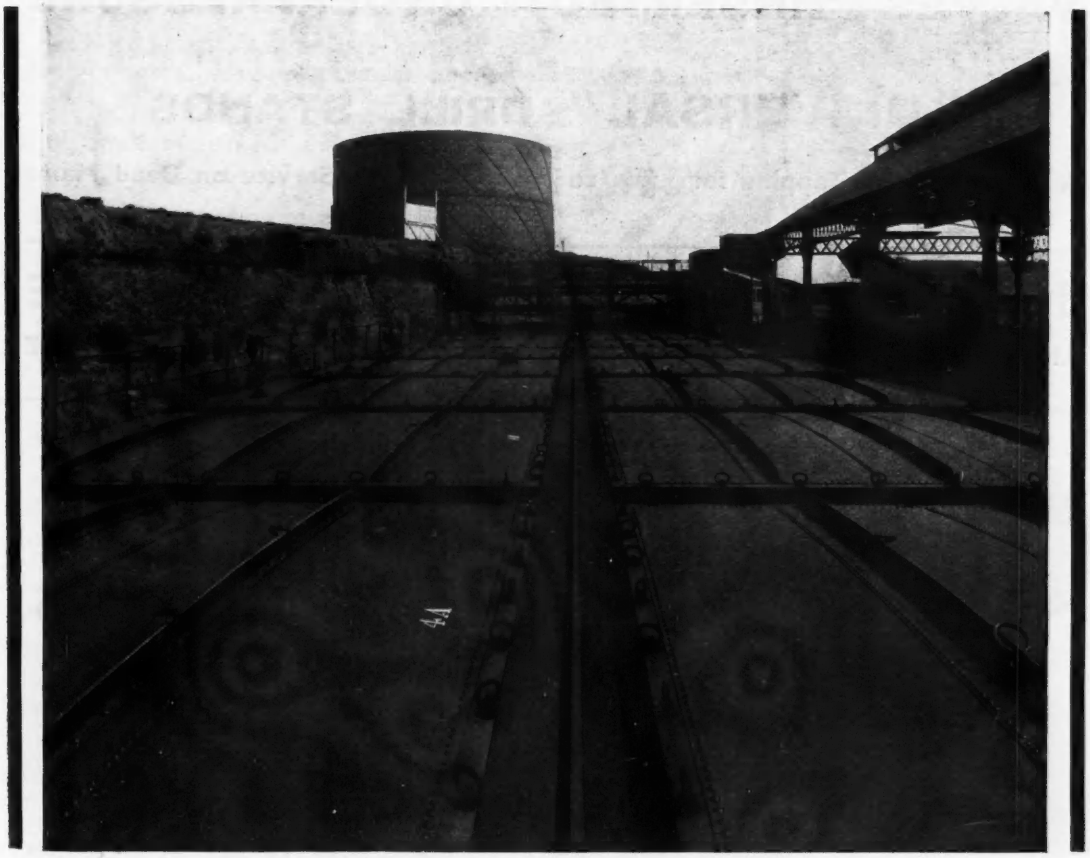

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Specially durable for coke and other abrasive materials—the long life is due to the special steel used and to the welding of every intersection. "Girdex" Weld-Fabric Screens are made specially for the Gas Industry.

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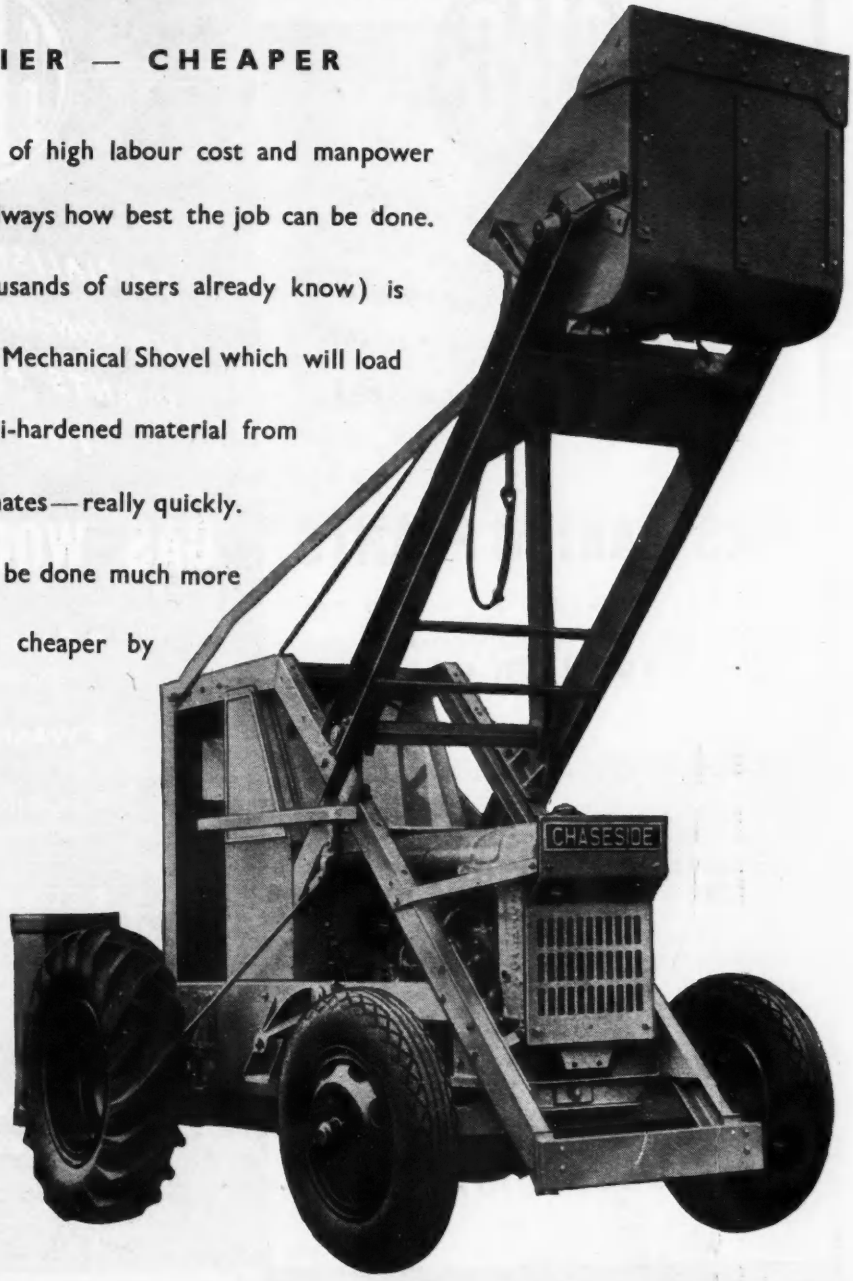

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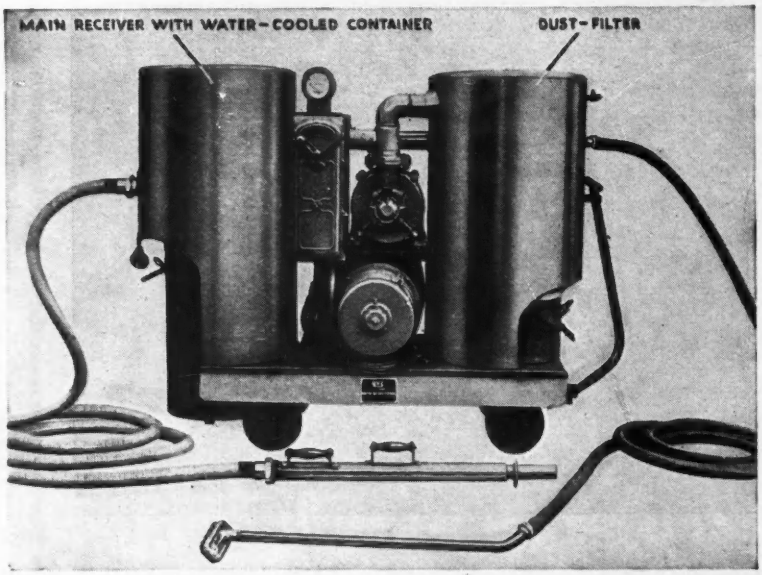
Product of Radiation Ltd.

THE B.V.C DUAL-PURPOSE GAS WORKS MODEL



The B.V.C. Dual-Purpose Gas Works Model is a very efficient mobile unit, with water-cooled container for the removal of hot dust from the tops of retorts. Can be used for general cleaning by either one or two operators.

We shall be pleased to send you full information on request.

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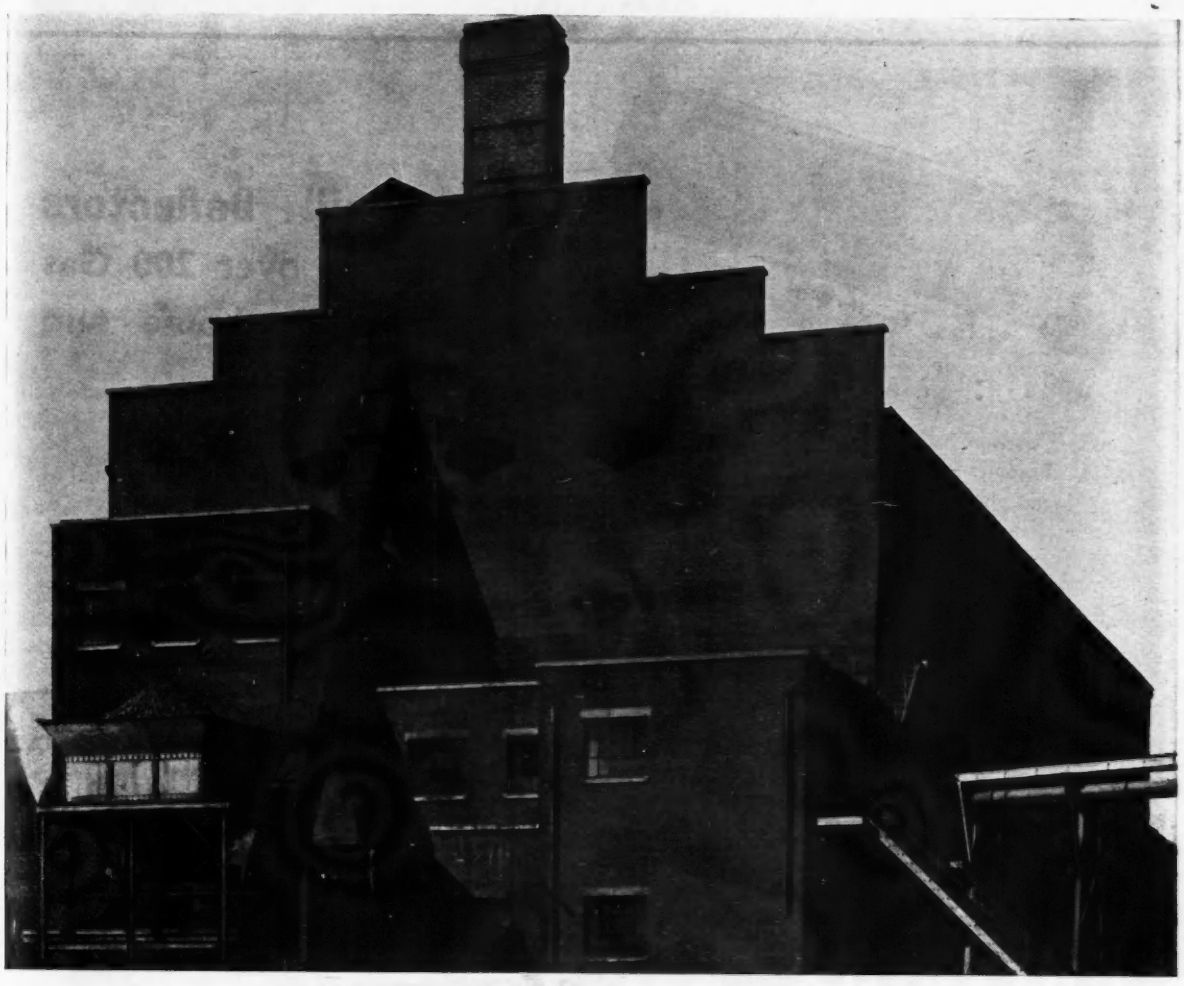

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RECONSTRUCTION OF HORIZONTAL RETORT HOUSE ON MODERNISTIC LINES

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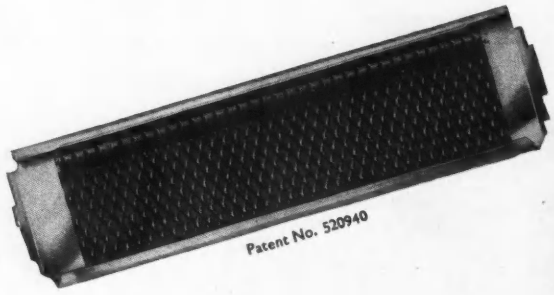

Chrome Grill Deflectors
as supplied to over 200 Gas undertakings at home and overseas.

Becomes incandescent in 40-60 seconds and gives 3,700 heat hours on alternate heating and cooling.

Made from Firth-Vickers F·120 heat - resisting chrome steel.

AVAILABLE FOR ALL TYPES OF GAS COOKERS.

Manufactured under Licence by

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BREAKING AND AERATING OXIDE

An entirely NEW method

The Howard ROTARY HOE, an implement which has revolutionised cultivation in agriculture, is being successfully applied by leading Gas Undertakings to this exacting task. Its power-driven rotor is fitted with self-sharpening blades which readily divide the larger compacted lumps of oxide, and at the same time, lift, pulverise and thoroughly aerate all ore over which the machine passes, to a pre-determined depth. It has been found that the ROTARY HOE, driven by one operator, will carry out in 4 hours, work which formerly occupied 4 days of manual labour. The standard 6 h.p. machine is used, without modification.

We shall be pleased to forward full particulars and arrange a demonstration on request.

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LABOUR-SAVING • ECONOMICAL • EFFICIENT

This 50ft. C. & T. STACKER when fed by mobile shovels is capable of stacking 48 *Tons of Coal or* 30 *Tons of Coke per hour* 22*ft. high.*

FOR HIGH CAPACITY USE C & T EQUIPMENT

Phone: St. HELENS 3397.

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SUTTON OAK, ST. HELENS, LANCS.

Cables: CRONTAYLOR, St. HELENS, ENGLAND.

This C. & T. Oxide Breaker when charged by this C. & T. Mobile Feeder will break 30 *Tons of Oxide per Hour* (Note: C. & T. do not make Mobile Shovels).

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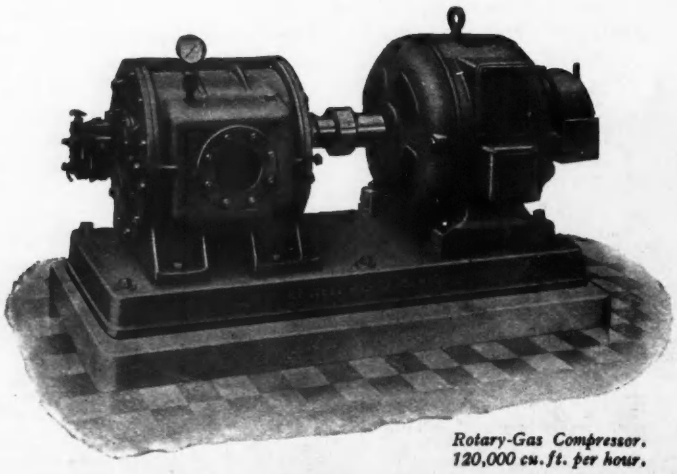
Illustrated above are two Turbo Boosters with capacities of 2,000,000 cubic feet of gas per hour each. They are direct-coupled to Steam Turbines.

We have supplied numbers of Steam Turbine and Motor Driven Exhausters for Coke Oven Plants; Steam Turbine, Motor and Gas Engine Driven Gas Boosters and Rotary Compressors for Transmission and Distribution Purposes; Portable Compressor Units for Breaking up Roadways with Pneumatic Picks for Laying Gas Mains, and for Caulking and testing Pipe Lines; and Turbo Blowers for Water Gas Plants. If you send us particulars of your requirements we will quote you for suitable plant.



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Write to Dept. "J" for illustrated pamphlets, giving full particulars of our manufactures.

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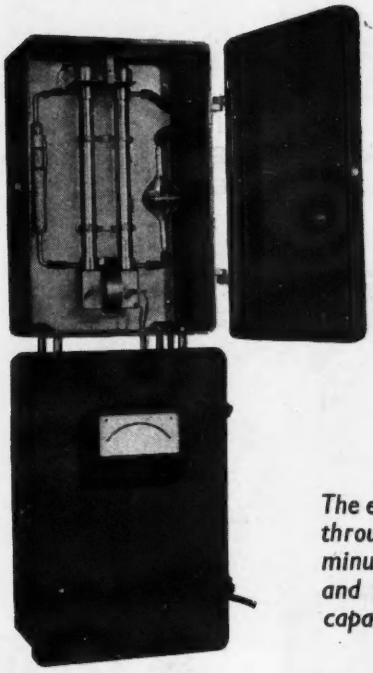

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Measurements by the INFRA RED ABSORPTION method are INSTANTANEOUS and SPECIFIC

Our instruments are particularly suitable for the tests proposed for revision of

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Two Special models for this purpose are available as indicators (illustrated) or recorders

(1) 2 Range CO 0-0·05% & 0-0·25%

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The exhaust gases from a gas burning appliance under test may be drawn through the CO instrument by a filter pump at a rate of 3 or 4 litres a minute. The delay in final reading is then not more than 8 seconds, and changes will show in two or three seconds. Owing to its smaller capacity these times are shorter for the CO_2 instrument.

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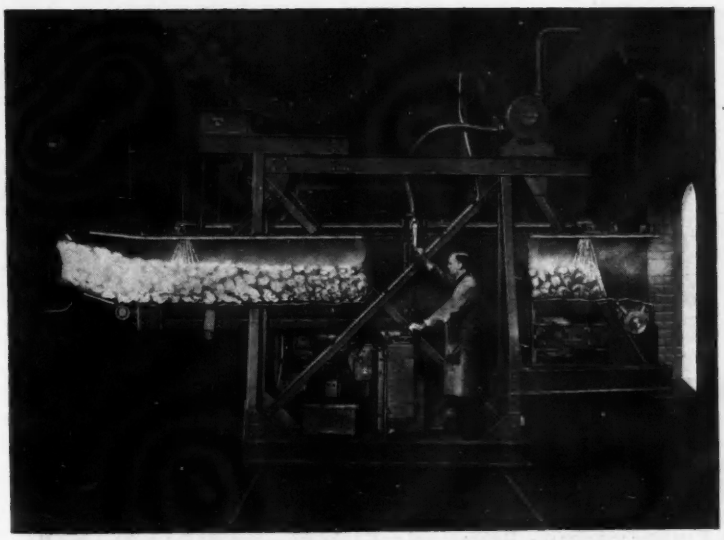

The
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quenches coke effectively and produces the finest grade of Silver Grey Fuel. It receives from any Retort, expels the charge in 15 secs. per Retort, is quick, quiet and economical in operation. It discharges at any desired point, and picks up water during travel.

Operator is protected from heat, and there is no steam in the house.

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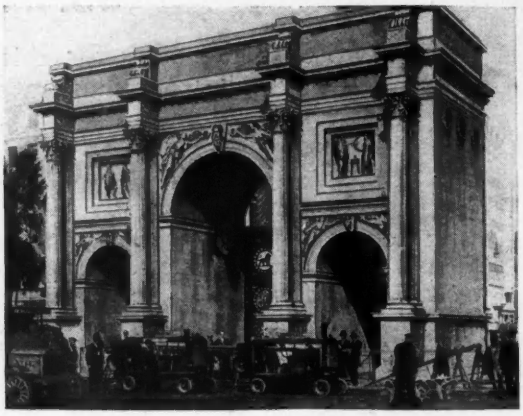

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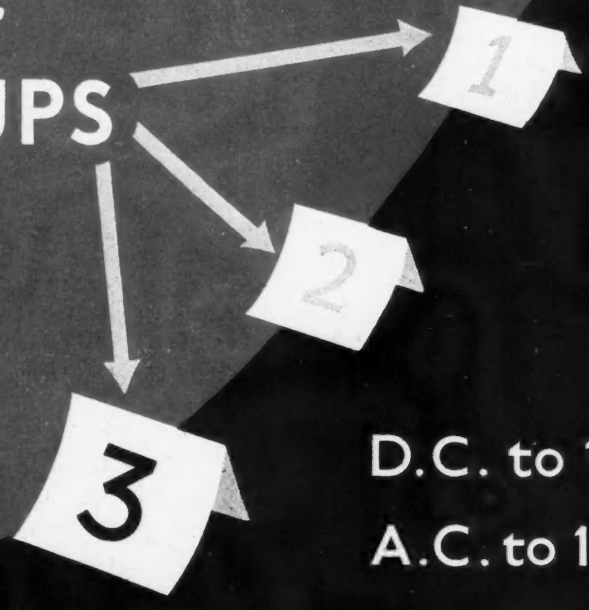
BUXTON CERTIFIED *for* GROUPS



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"Whether it be laying a new main or enlarging an old one, problems will inevitably arise. Perhaps you may have to overcome obstructions such as G.P.O. cables, water mains, or sewers.

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The time is ? Look at your watch !
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Just like that . . . . . instantaneous
The pointer moves . . . it may be to .495 or to .505
You know the new value, on the *instant*
"*But the apparent change* ***may*** *be due to a change in Gas Volume Factor*" you may ask !

THE SIMMANCE PATENT GRAVITOMETER

compensates automatically for all changes in Gas Volume Factor

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2

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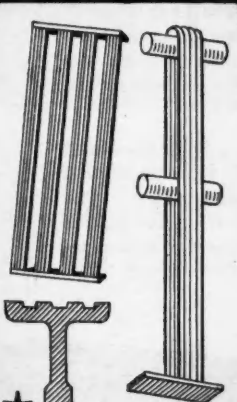

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- Every bar welded . . . no rivets to work loose
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G

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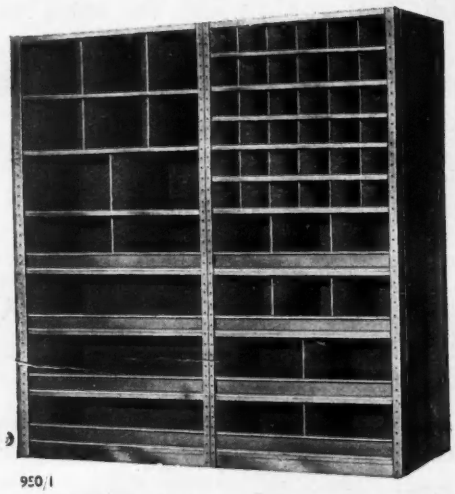
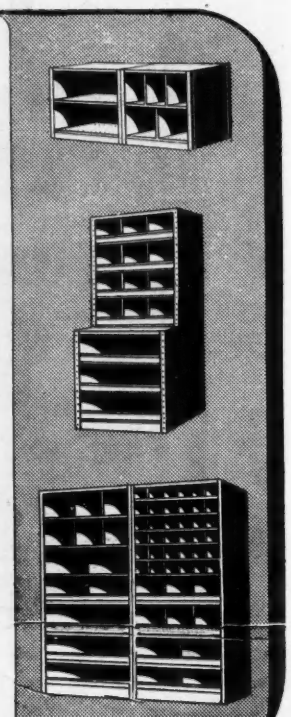
"SECO"

STEEL STORAGE EQUIPMENT FOR FACTORIES AND STORES





WE specialise in the production of steel storage bins, racks and extendable storage systems to suit all requirements. Seco Steel Equipment can easily be assembled by unskilled labour on site.

We also manufacture specialist installations to customers' own specifications. Seco Equipment gives maximum storage capacity to minimum space available. The illustrations show typical examples of the Seco Standard Units now available.

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"Yes, Sir! Absenteeism is down and we've saved on lighting bills."

Hills Ventilating Shutters, by creating a draught for the extraction of polluted air, and providing adequate natural light, cut down absenteeism losses by their beneficial effect on workers' health; increase production and reduce lighting and glass-cleaning bills.

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M-W.38

CASTINGS for SPECIALISED PLANT

The illustration shows a MOTOR DRIVEN VACUUM DRYER 7 ft. 9¾ in. diameter x 2 ft. 6 ins. deep. Steam Heated by Coils Cast in the Body and Base.

High standards, backed up by close supervision over all materials and workmanship, assure the unvarying good quality of Widnes Castings. Widnes Foundry have the facilities, the men and the experience to produce the most intricate and accurate special-purpose castings — and this combination is at your service from the moment you get in touch.

Specialists in the production of Cast and Fabricated vessels and equipment in cast irons, mild and stainless steels for the chemical, oil, food and allied industries.

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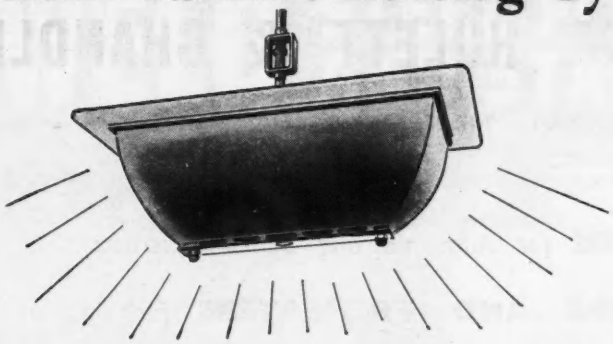
London Office : BRETTENHAM HOUSE, LANCASTER PLACE, STRAND, W.C.2

Overhead radiant heating by gas

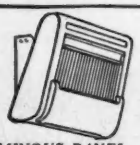


Like the sun, Bratt Colbran Overhead Radiant Heaters radiate their heat *downwards*, providing a comfortable temperature that is invigorating and free of stuffiness. They are also: ECONOMICAL — they direct unobstructed heat *where* it is wanted and only *when* it is wanted. QUICK IN ACTION — they can be switched on and off instantly under individual, grouped or thermostatic control. EFFECTIVE — they can be arranged to give even or directional heat distribution, which quickly gives a measure of comfort even at a low air temperature. Radiant heat is particularly effective in semi-open buildings. SAFE — they are out of reach of accidental contact. SPACE-SAVING — they can be suspended from roof, wall or cross-beam. CONVENIENT — they can be installed quickly and economically, without interfering with the use of the building. SIMPLE — once installed they are good for years with minimum maintenance.

There are four designs of Overhead Radiant Heater: the Wedge Heater (above), the Luminous Panel, the Bowl, and Wall Heaters (shown below). All are noiseless and each has its own special advantages. Between them they solve the heating problems for a wide range of new and existing buildings: factories, workshops, churches, public halls, schools, restaurants, shops, stores, offices.

WALL PATTERN

BOWL PATTERN



LUMINOUS PANEL

Consult your local gas undertaking, or write for technical advice on installation to:

Bratt Colbran

PIONEERS IN OVERHEAD RADIANT HEATING

BRATT COLBRAN LIMITED 10 MORTIMER STREET LONDON W1. TEL: MUS 9411 (7 LINES)

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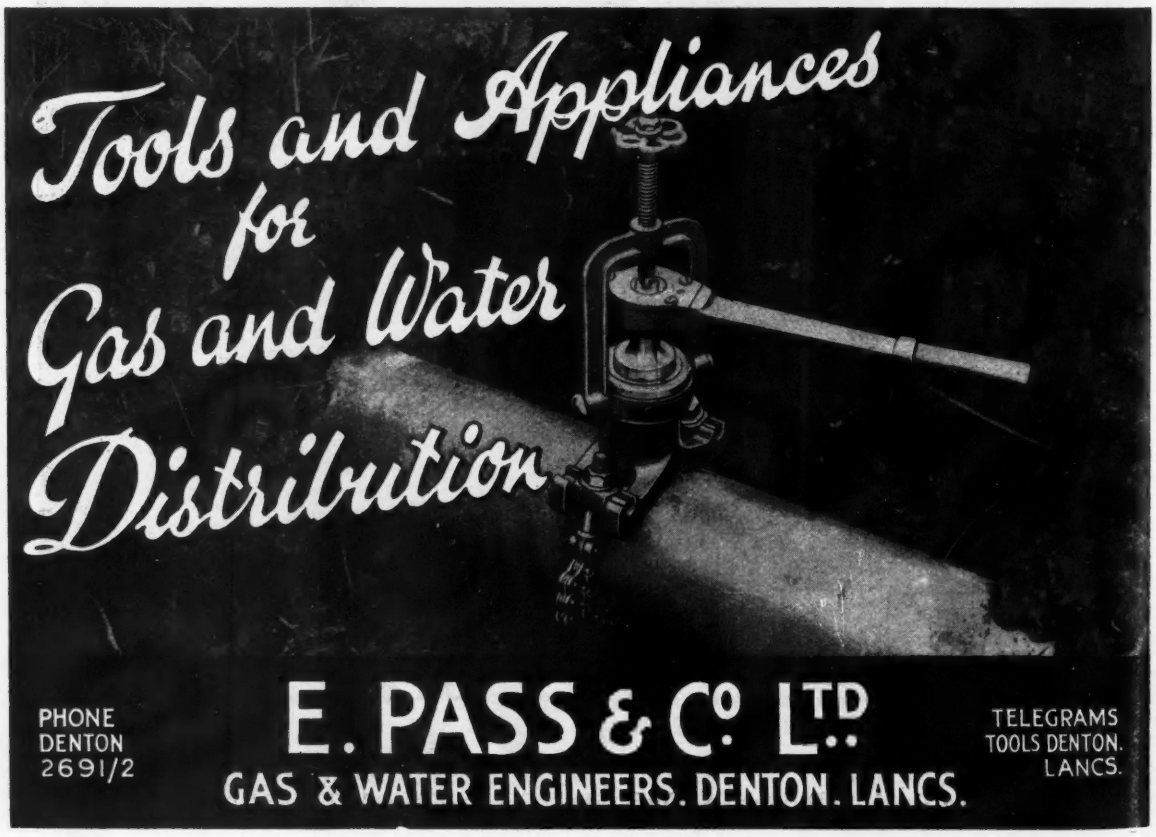
Phone : TEMPLEBAR 2943 *Grams :* WASHER, ESTRAND, LONDON



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GAS & WATER ENGINEERS. DENTON. LANCS.

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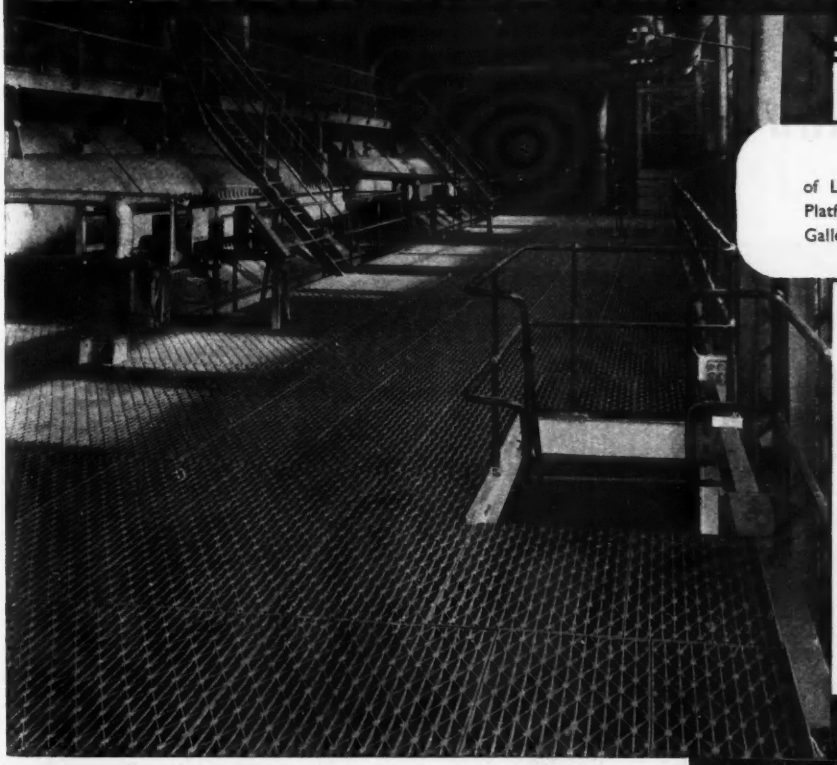
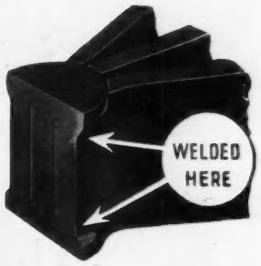
LIONWELD STEEL FLOORING AND STAIRWAYS



A COMPLETE installation of Lionweld Steel Flooring for Access Platforms, Staircases, Handrailing and Galleries.



SECTION through electrically welded Lionweld joint.

OUR SERVICES are at your disposal regarding design of Open Steel Flooring and Stairways for Access Platforms and Gangways in any type of building.

Lionweld Open Steel Flooring has a high load carrying capacity for span and allows light penetration and ventilation.

MANUFACTURERS of Lionweld Patent Electrically Welded Open Steel Flooring and Stairtreads, Light Supporting Steelwork, Handrails and Handrail Standards, etc.

SUPPLIERS to Admiralty, War Office, Air Ministry, Gas and Chemical Industries.

WRITE for copy of our illustrated catalogue, detailing the full range of our products.

A TYPICAL example of Lionweld complete Staircases, Handrailing and supporting Steel work.

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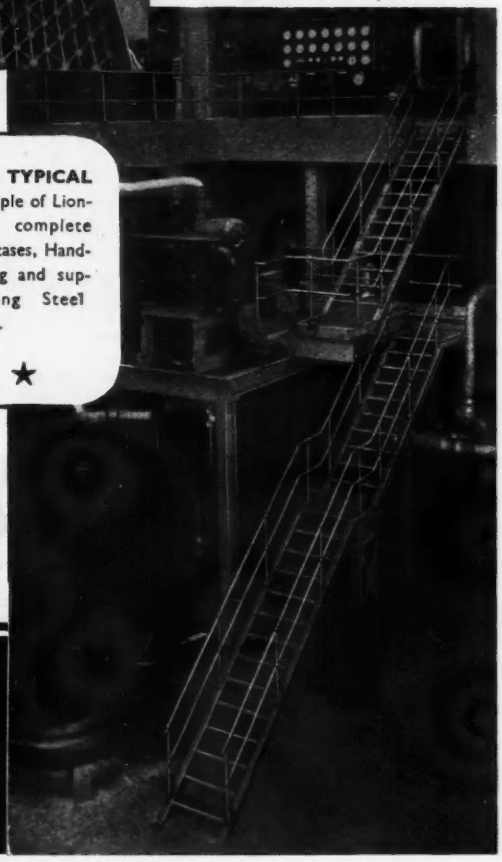

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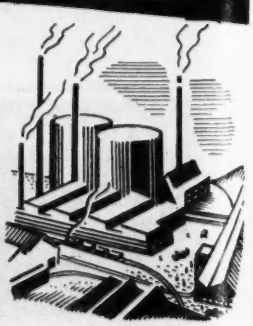
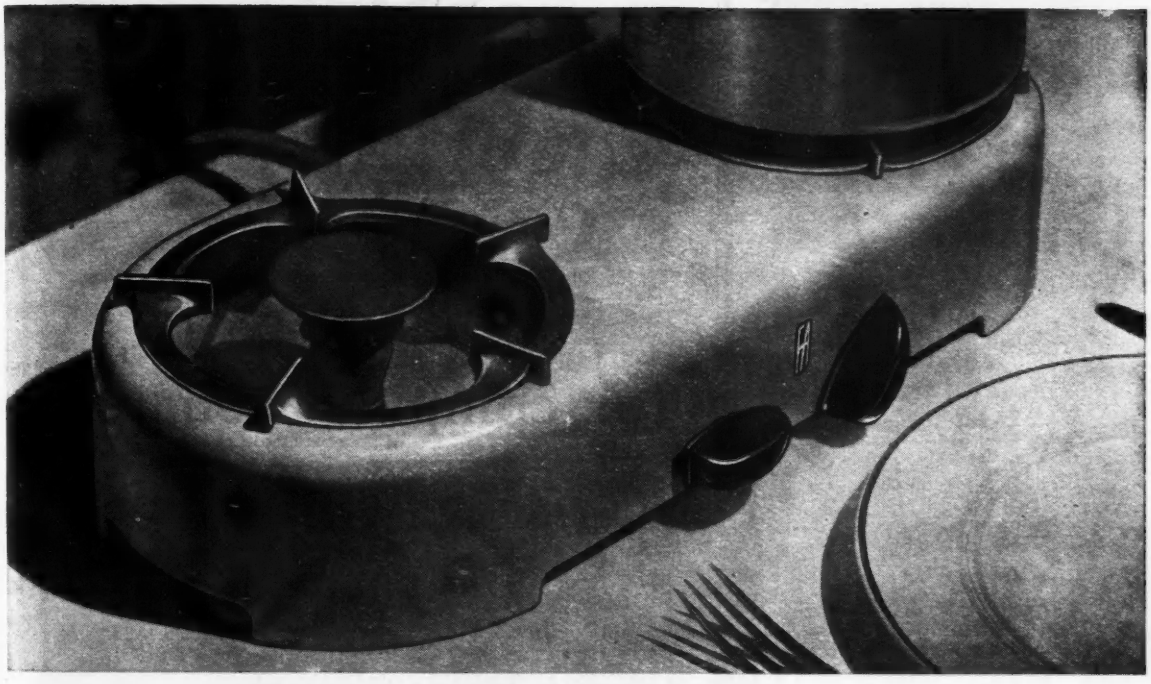


The Gemini of heating

is here before you



THE FA-NEAT GAS TWO-BURNER HOTPLATE

TYPE FA/2

Stars of the domestic scene, these twin burners are equally "bright" at fast boiling or slow simmering.

An efficient auxiliary appliance for use with existing cooking equipment or as a hotplate, they save endless journeys between kitchen and dining room, enabling second or third courses to be served "piping hot" from the buffet.

Incorporating two FA-Neat Gas Burners, each controlled by a separate tap, the robust body is finished in grey mottled or cream vitreous enamel, tastefully blending with diverse surroundings.

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for complete reliability

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Controller. The type 3A/UNI Controller, which is being increasingly accepted as the standard for such equipment throughout the world, provides, in combination with the Comet Igniter, the last word in modern automatic control.

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Complete retort house and exhauster house instrument and control panels. Gas producer and purification plant control. Distance transmission of district measurements and remote control schemes. Alarm and signalling systems.

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Sensitive relay governors for vacuum, pressure, air/gas ratio, gas mixing, and C.V. control. Electrically-operated and air-operated regulators for temperature control.

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Factories:
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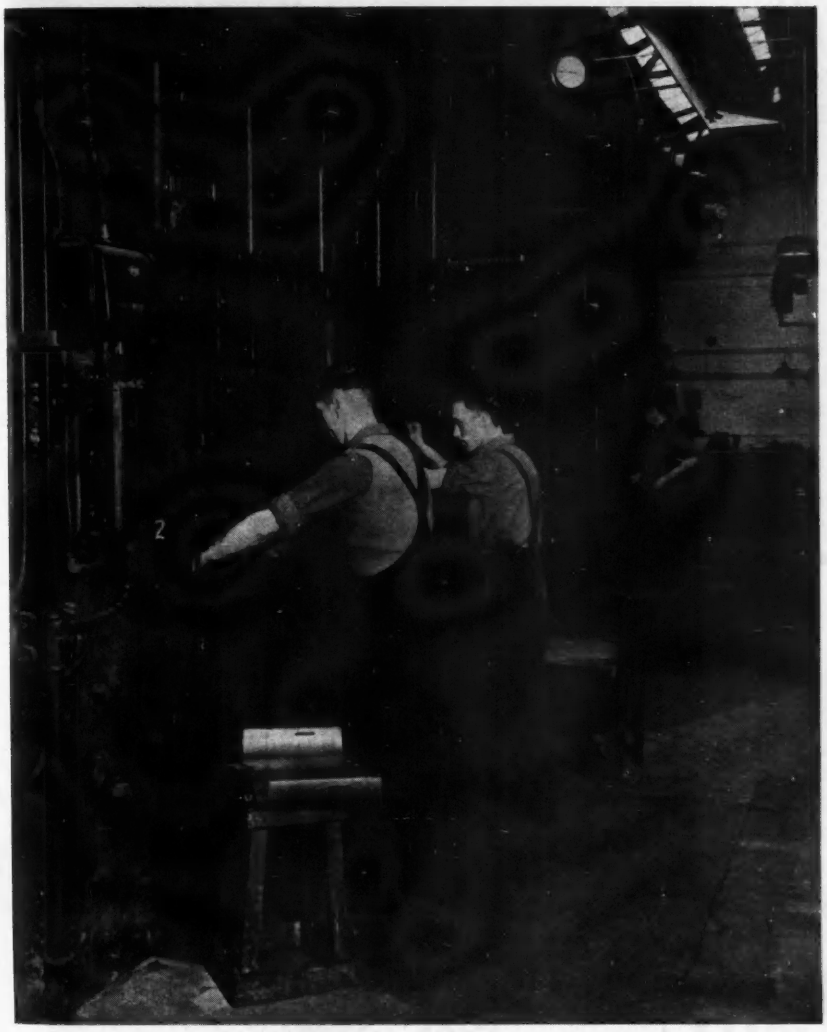
A Factory at Work



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The cooker cleaner

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The quickest and cheapest way to lift most loads of from 5 cwts. to 10 tons is by King Electric Chain Pulley Block. King Blocks are built for continuous heavy duty and are made in three models: Minor, Major, and Mammoth. Each block is fitted with push button control, and patent limit switches for top and bottom travel and to guard against incorrect feeding of the chain. Write for illustrated booklet.

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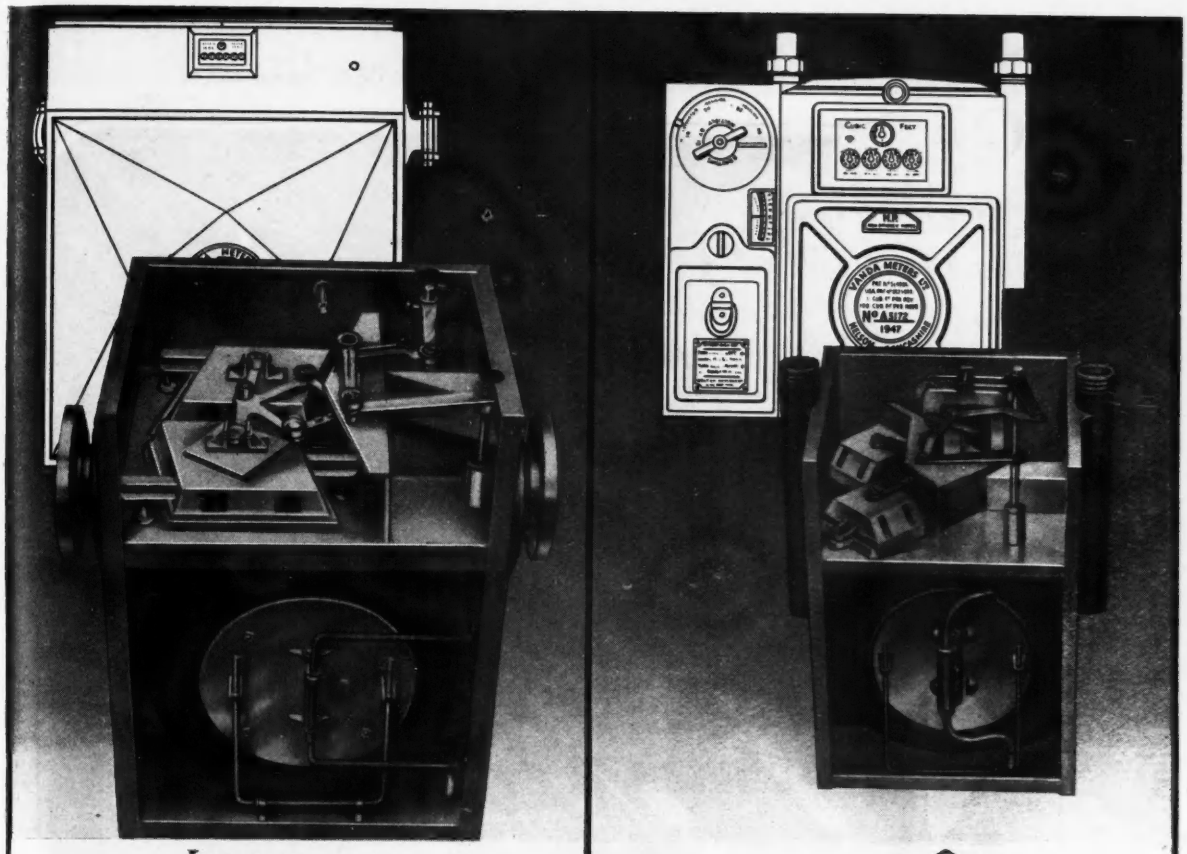

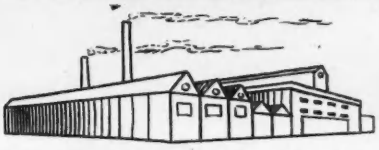

M-P

HIGH EFFICIENCY GAS METERS

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Vanda 'MP' Industrial Meters accommodate loads from 450 c.ft. per hour to 30,000 c.ft. per hour. They register accurately with low absorption figure, and their short valve travel gives long trouble free life. If space is in short supply use 'MP' Small Case type. H.C. Standard case sizes supplied when required.

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Vanda 'MP' Meters fitted with Multi-ported Valves (British Patent 514956) are now available in usual range, Ordinary and Prepayment (3 types). The 'MP' Valve has low linear valve speed, and VALVE SPEED IS TRUE METER SPEED.

All meters comply with I.G.E. specifications.

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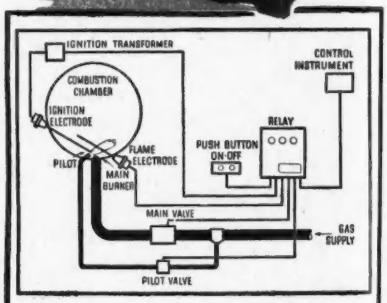

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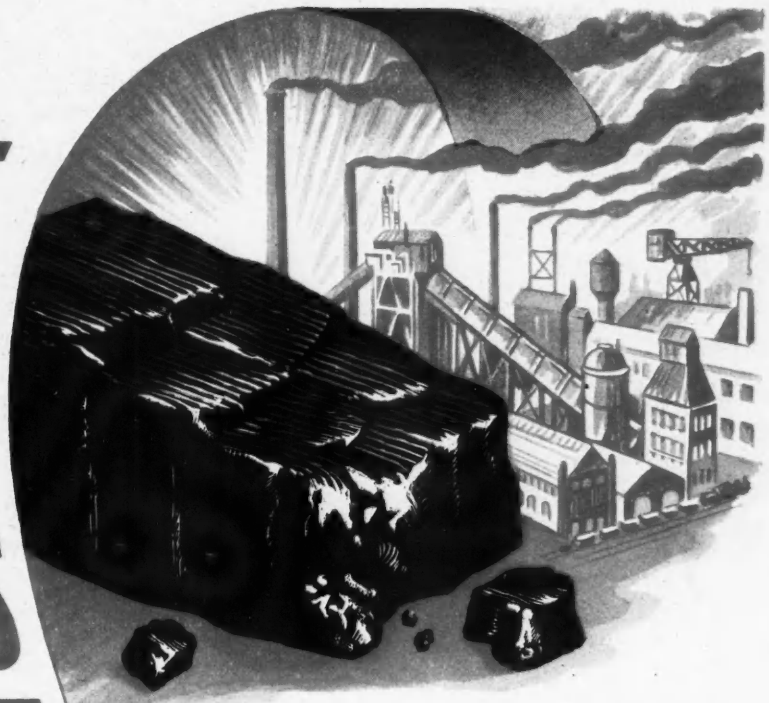

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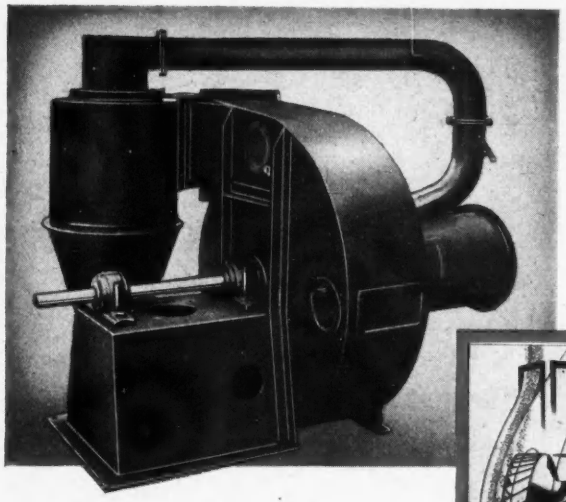

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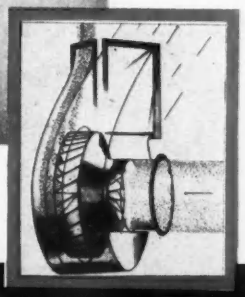

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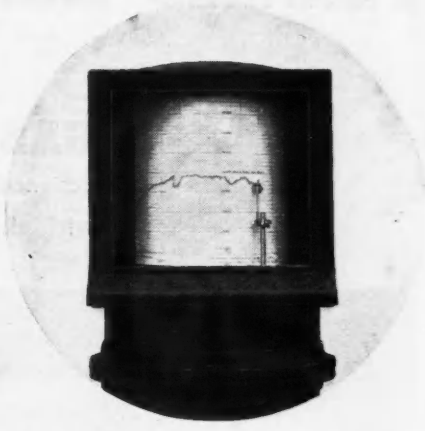

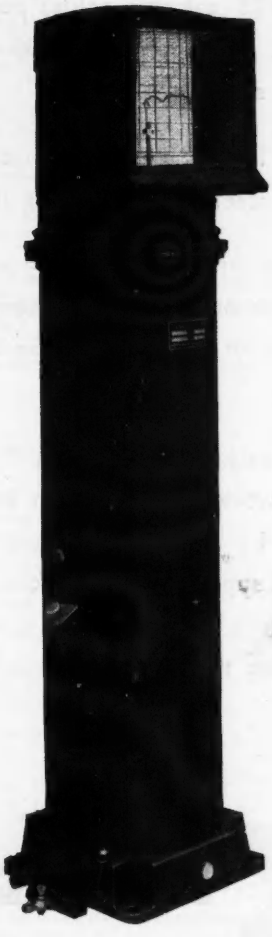

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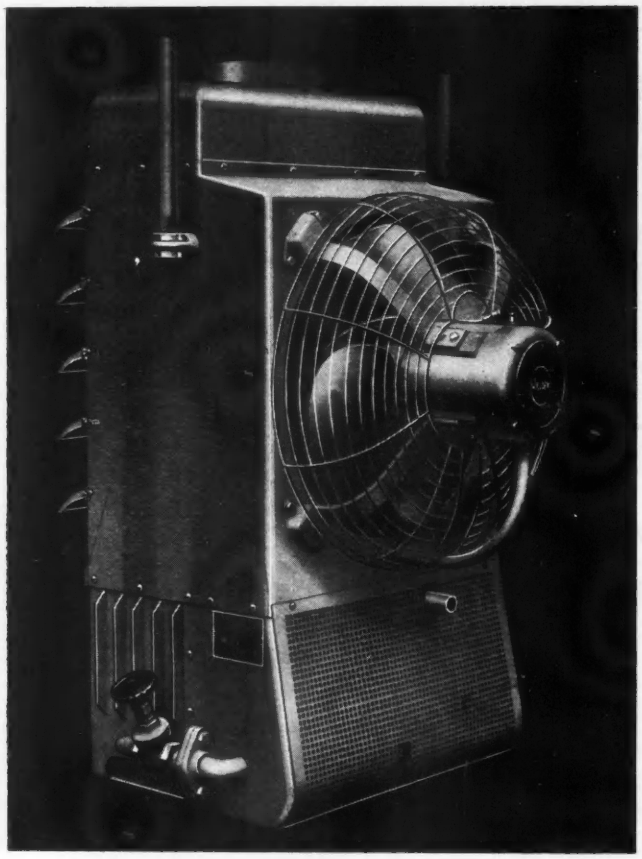

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Point to a joint
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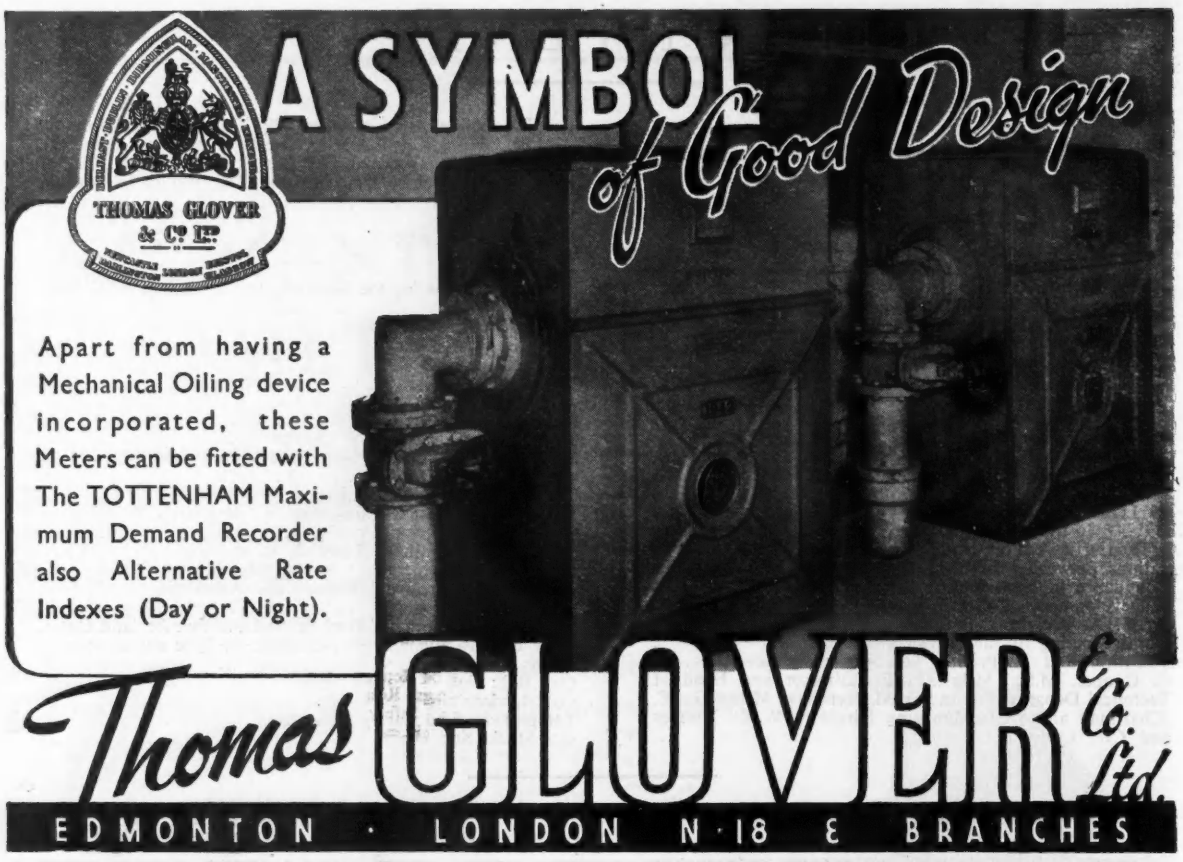
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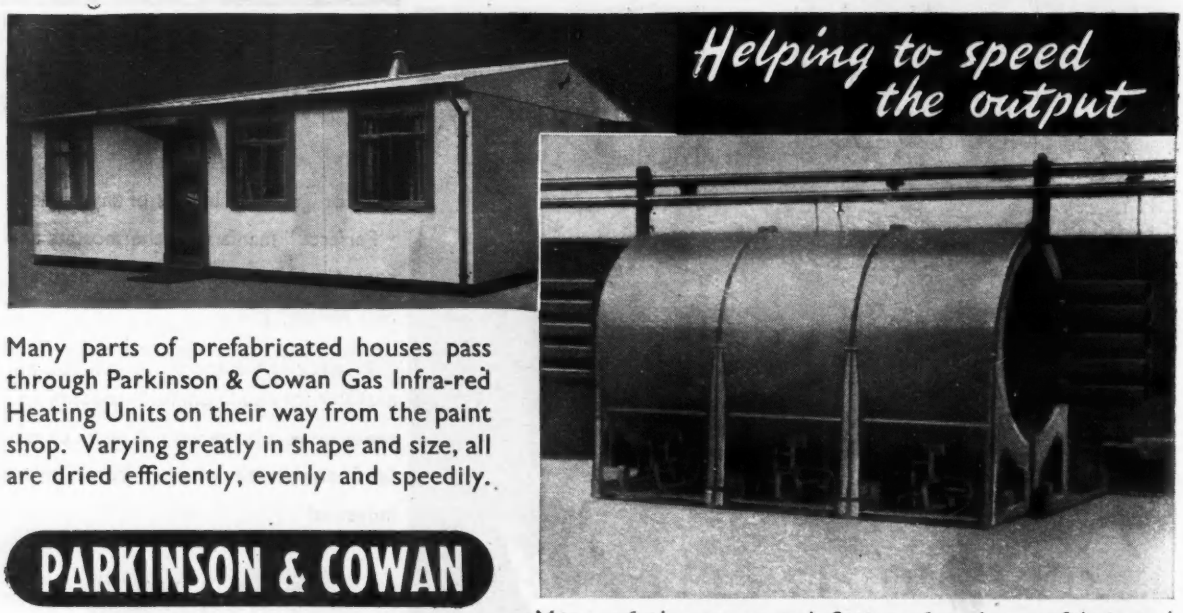

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Vol. 254 June 16, 1948 No. 4437

THE INSTITUTION MEETING, 1948

THERE were 800 present in the Large Hall, Friends House, London, on Tuesday morning of last week when the 85th annual general meeting of the Institution of Gas Engineers was opened under the Presidency of Dr. Harold Hartley, Deputy Chairman, Radiation Ltd., whose first duty was to greet a number of official delegates of overseas Gas Associations, and also a number of members from overseas and one visitor from the Continent. The Danish Association was represented by Mr. Richard Jakobsen (Copenhagen); the French Gas Association by Mr. E. Biard, M. V. Louis, M. A. Papillon, M. A. Renauldon (all of Paris); the Netherlands Gas Association by Professor G. A. Brender à Brandis (Wassenaar); the Norwegian Gas Works Association by Mr. J. C. Irminger (Bergen); and the Swiss Gas and Water Association by Mr. Markus Treschel (Solothurn, President), and Dr. H. Deringer (Winterthur). The overseas members were Mr. Edgar Foster (New South Wales, Australia), Mr. H. D. Greenwood (Control Commission for Germany), Mr. A. S. Grime (Rio de Janeiro), Mr. T. J. Henriques (Rio de Janeiro), and Mr. A. M. Stickels (Shanghai). The overseas visitor was M. J. Duval (Paris).

The President then informed the meeting of messages of greetings from overseas Gas Associations: From Mr. J. R. Duggan (President, the Australian Gas Institute), Mr. H. Carl Wollf (Managing Director, American Gas Association), the Belgian Gas Association, and Dr. T. Keclik (Prague, Vice-President of the International Gas Union).

The President formally moved the adoption of the 85th Annual Report of the Council and Accounts for 1947.

The President: You have before you the 85th Annual Report of the Council of the Institution, covering the year 1947/48, and the Accounts for the year 1947. I will therefore move: That the 85th Annual Report of the Council of the Institution of Gas Engineers for the year 1947-48 and the Accounts for the year 1947, which have been printed and circulated to members, be taken as read.

Mr. W. J. C. Garrard (Ipswich) seconded the motion.

Election of Officers

The report of the scrutineers of the ballots for the election of officers, auditors, and ordinary members of Council was as follows:

President: 1948-49, Edward Crowther.
Vice-President: 1948-49, F. M. Birks, C.B.E.
Auditors: 1948-49, H. C. Smith, C.B.E., D.L., J.P., and A. H. Morland.
Hon. Secretary: 1948-49, John Terrace.
Ordinary Members of Council: 1948-51, T. R. Cook, J. T. Haynes, Dr. Harold Hollings, and G. P. Mitchell.

The election was announced of 15 Honorary Members, 32 Members, 78 Associate Members, and 28 Associates.

The following were elected District Members of Council: F. Allen (Clacton; Eastern), R. Cowie (Hawick; Waverley), O. P. Cronshaw (Rhyl; Wales and Monmouthshire), P. Dougall (Kidderminster; Midland), L. P. Ingram (Taunton; Southern), J. MacLusky (Halifax; Manchester), D. D. Melvin (Edinburgh; North British), F. W. Sansom (Exeter; British Junior Gas Associations Joint Council), P. J. Sheenan (Cork; Irish), F. Wilson (Darlington; North of England).

Presentation of Medals

This brought us to the presentation of the following medals:

Institution Gold Medal, 1947: To G. M. Rimmer, A.M.I.E.E., N. American I.E.E., for his paper on "Electricity in the Gas Industry," read at the 84th annual general meeting of the Institution of Gas Engineers in Birmingham in 1947;

H. E. Jones London Medal, 1947: To N. Noone and A. G. Grant, M.Sc., for a joint paper on "The High-Pressure Gasholder," also read at the Birmingham meeting in 1947;

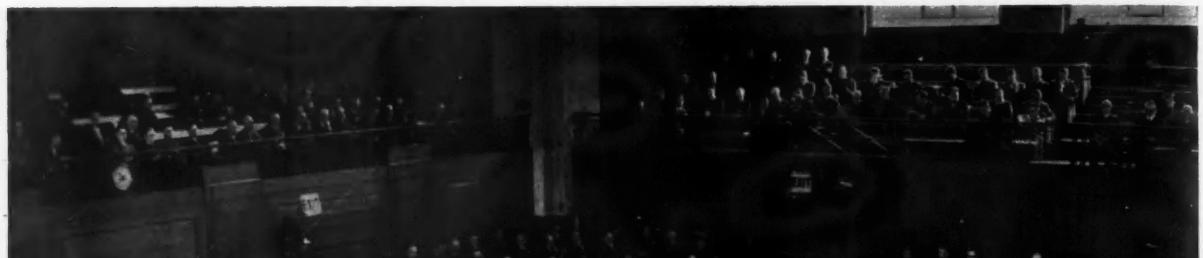
Institution Silver Medal, 1947: To A. K. Collinge, for his paper on "Four Years' Developments at Preston," read at the autumn meeting of the Manchester District Association of Gas Engineers in 1947;

Institution Bronze Medal, 1947: To J. A. Speers, M.Sc., for his paper on "The Influence of Packing Density in Purifiers on Resistance to Gas Flow," read at the half-yearly meeting of the North of England Gas Managers' Association (Auxiliary Section), December, 1947.

Presidential Address

Dr. Hartley then delivered his Presidential Address, which is published in full in this issue.

Mr. S. E. Whitehead, of Southampton, proposed a vote of thanks to the President. He said: "The President opened by referring to two events which have happened during his year of office. The first one is that 'the Government is taking steps to integrate the gas undertakings on a regional basis.' I do not propose to dispute that; it is a question of fact. But I should like to congratulate the President on his wording. I cannot believe that any member of the supply side of the industry could have thought out such a moderate and tactful definition of the word 'nationalization.' The second event is the proposal to purchase headquarters for the Institution. This is a most important matter and we should be most grateful to the President for the inception of the scheme as well as for the tremendous amount of work and thought that he has put into it. I am sure we all wish the appeal every success, and in this connexion we should all join the President in thanking the Minister of Fuel and Power and his chief officials for their understanding and helpful attitude in the matter. This provision of our own headquarters is in my opinion the third of the most important milestones



The Large Hall of Friends House presented a packed appearance at Tuesday's opening session.

in the Institution's history. The first was the granting of our Royal Charter in 1929, and the second was the broadening of the basis of admission to include designers and builders of plant, and the chemists and physicists not only of our own undertakings but of the appliance and plant makers. This decision has been amply justified by subsequent events, but if any doubt had existed it would have been completely dispelled by Dr. Hartley's year of office.

"The President," concluded Mr. Whitehead, "once more indicates his firm faith in the future of the gas industry, but makes it clear that in his opinion its success is subject to certain provisos. The chief of these—perhaps rather implied than stated—is that our work must be guided at all points by competent engineers, chemists, and physicists, and by the application of scientific methods of investigation and research. These surely are among the main functions of the Chartered Institution of Gas Engineers, and we can therefore derive from the President's address not only a great deal of sound advice and help for the future, but also considerable encouragement."

Mr. D. M. Henshaw (Past Member of Council of the Institution, and Vice President of the Gas Research Board), in seconding the vote of thanks, said that Dr. Hartley had given them a clear-cut analysis of the functions of the Institution, and also of the problems facing the fuel industries at the present time. The address, as the President described it, dealt for the most part with material considerations which would have an influence on future events. Speaking as a contractor member of the Institution and on behalf of the Society of British Gas Industries, which owed a great debt to the President for his many services in the advancement of appliance manufacture, Mr. Henshaw remarked that he would like to take the opportunity of expressing gratitude for the work which Dr. Hartley had done. Dr. Hartley achieved a reputation of an international character by his inspired leadership first as Chairman and latterly as President of the British Cast Iron Research Association, one of the oldest Research Associations affiliated to the D.S.I.R., which recently celebrated its silver jubilee. Dr. Hartley's outstanding capacity for getting things done not only in the field of research but also administratively was recognized throughout those innumerable industries to which the work of foundry production was so vital at the present time.

The vote of thanks was carried with acclamation.

The President: You have obviously been carried away by the occasion! No man could be fully deserving of the praise which you have heaped upon my head. Whatever I have been able to do I have done gladly and, as I have said, with enjoyment; but you, Mr. Whitehead, especially must know that no man could fulfil the duties of this office unless he had behind him a staff upon whom he could rely and colleagues whom he knew would support him. It is because I have had that backing that I have been able to play my part, however good or feeble it may have been, in the affairs of this Institution.

I am glad of this opportunity of acknowledging my indebtedness to the staff and to my colleagues, and I thank very much both the proposer and seconder for very nice things they have said, and you for the kindly manner in which you have received them.

The Gas Industry in the Netherlands

Professor G. A. Brender à Brandis, of the University of Delft, President of the Vakgroop Gasbedrijven, The Hague, then presented his paper entitled "The Development of the Gas Industry in the Netherlands." In this paper the author commented on the fact that the British gas industry, which operated so efficiently, is to be taken entirely out of private hands and is to be nationalized. In the Netherlands, where municipal control has been the general rule for a considerable time, there is a tendency towards the opposite direction. This does not signify that it is intended to put the gas industry entirely into private hands again, but there is unquestionably a tendency to entrust the operation of gas manufacture to limited companies. Although the shares will be held largely by the Government, participation of private undertakings will certainly not be excluded. For this tendency the following explanation is evident:—

The era wherein were established a multitude of large and small gas works is drawing to a close. Everywhere there is a tendency to concentrate on large undertakings, whether combined with chemical industry, or not. Such large concerns cannot very well be conducted directly by the community. The Netherlands gas-works of yesterday and to-day was, or

is, essentially a municipally controlled service rather than an undertaking. Such a works is run by a manager who is more or less responsible for its operation, subject to the more or less liberal ideas of the particular municipal authority; but in the last resort decisions are taken by the municipality, which in its turn is influenced by political parties. The gas-works of the future will be a real chemical undertaking of considerable importance—not so much a gas-works in the narrow sense as a complicated chemical refining plant, which should supply not only a municipality but an entire district with gaseous energy.

Following the discussion on the paper (see later pages) the meeting adjourned, and during the interval there was the President's Luncheon at the Savoy Hotel, at which the principal guest was the Minister of Fuel and Power, Mr. Hugh Gaitskell. Our report of the proceedings will be found on p. 664.

Gas Production in Perspective

On resumption of the meeting on the Tuesday afternoon a paper was presented on this subject jointly by Mr. T. C. Finlayson and Mr. F. S. Townend, of the Woodall-Duckham Company. Among many processes on which the authors comment is the Lurgi high-pressure gasification process. The authors state that a study of the available information suggests that to obtain a proper perspective of this process the following features require noting:—

(1) The process depends on using medium-purity oxygen, say, 85 to 98% purity. The power required by such a plant is high, and only by strict co-ordination of power and process steam supplies would it be possible to avoid a heavy running cost.

(2) The process must be operated on a large scale, probably 30 to 50 mill. cu.ft. per day output, so that the provision of the oxygen plant in several units to give flexibility and continuity of supply is economically possible.

(3) Practical experience with bituminous coal is required.

(4) The carbon dioxide and hydrogen sulphide which are removed by washing the gas with water under pressure are given off from the water after it has left the washing tower. There will be 3 to 4 mill. cu.ft. of a mixture of carbon dioxide and hydrogen sulphide gas (containing up to 1% hydrogen sulphide) for every 10 mill. cu.ft. of finished gas made, and the most practicable way of dealing with this gas has yet to be ascertained.

(5) The effluent liquor has a very low ammonia content and in quantity per therm of gas appears to be twice that which has to be dealt with from normal high-temperature carbonization plant. It is very high in phenol content.

The subject of high-pressure gasification of coal, including the production of methane by the reaction of hydrogen on coal under conditions of high pressure is under active investigation by the Gas Research Board, and the above problems will no doubt be considered by it. Once the high-pressure gasification process in some form or another has reached a state of commercial development it may well play a part in a gas industry organized along regional lines, particularly if the demand for gas outstrips the demand for coke. But, on present evidence, it is difficult to envisage this process producing a therm of gas substantially cheaper than that obtained by normal carbonizing methods, provided the coke can be sold.

The paper and our report of the discussion are published in this issue.

Purification and By-Product Recovery

The final paper on the Tuesday afternoon was by Mr. D. M. Henshaw and Mr. C. Cooper, of W. C. Holmes and Co., Ltd., on purification and by-product recovery. The authors believe that integration of gas undertakings will proceed not necessarily on the lines which have been followed hitherto, but on lines prescribed by the creation of the Area Boards, each with some conditions peculiar to its own territory. In so far as these integrations call for new gas-production installations, it appears probable that larger unit sizes will be customary, and it is suggested that the maximum unit size is at present controlled by the size of the largest single stream that can be purified of H_2S. This may not, in the future, be so definite a limitation. The unification of gas production into larger single undertakings will, it is expected, have two main consequences. The first is that major changes in practice will involve a greater responsibility, which may be largely met by a more exact application of theoretical data existing or determined beforehand. The second is that it should make possible improvement in the character of the by-products made for sale. The authors believe that the residuals should come into the chemical market as far as possible as pure products, rather than be marketed as they are at present produced, for what they will bring as partially purified products. It remains true that the total cost of handling and purification, and the total revenue from the residuals other than coke, are no longer a large factor in determining the total cost of gas, and that quite minor changes of practice in carbonization, or even of distribution, may have a greater financial influence on costs. Nevertheless, failure to market effectively the residuals whose removal cannot be avoided (the tar, ammonia, and H_2S), and failure to deal properly with the disposal of waste matters, may have consequences apparently of much greater importance than appears at first sight.

The drafting of the paper was carried out at the time that the Gas Bill was issued, and many of the observations

The "GAS JOURNAL" photographer recorded the platform as Dr. Harold Hartley extended a welcome to members.

The photographs on this and opposite page were taken at the President's Luncheon. Above, Dr. Harold Hartley converses with the Rt. Hon. H. T. N. Gaitskell, Minister of Fuel and Power.

herein are necessarily made under the assumption that the present methods of management and administration must persist for a measurable time, that most existing producing units will continue to have requirements in relation to local developments, and that any elimination of existing plants would be done with a judicious regard to the undoubted difficulties in creating new producing capacity. It cannot, however, be expected that any particular suggestion of a probable line of development may not be fundamentally affected by official policy, any more than it is to be expected that such a development might not be prevented by the introduction of a new technique, the discovery of which has not yet been announced.

Reception and Dance

On the Tuesday evening a Reception and Dance was held at the Connaught Rooms, when those attending were received by the President and Mrs. Hartley. This highlight among the social events was attended and enjoyed by 870. The occasion was a triumph of organization.

Functionalism

" Functionalism " was part of the order of the day on Wednesday. Before we came to the paper by Mr. C. H. Leach, of Liverpool, the President read a lettter received from Mr. J. R. W. Alexander. The passage of especial note was: " At 2.30 a.m. the Government was understood to say that purchase tax on gas water heaters and space heaters would be reduced from 100% to 66⅔%, the tax on such apparatus operated by electricity remaining unaltered at 100%."

Mr. Leach, in presenting his paper on " Functionalism as a Tool of Management," said: " The process of management, as I see it, is somewhat analogous to catalysis, although I have never heard it so described. If the catalyst, or managerial decision, is the proper one, then by reason of its presence, beneficial changes take place. A managerial decision should be, if humanly possible, an immediate one. It may be that an immediate decision is not perhaps quite as good as the one which might have been given at a belated date after prolonged consideration, but it stimulates, whereas delay may easily negative any hypothetical benefits of an improved decision, and it is better in most circumstances to give an immediate workable solution to a problem rather than by delay to frustrate and damp the enthusiasm of those looking to managements to promote beneficial changes.

" There is no doubt in my mind that the most suitable conditions in which this catalyst should be present are those existing under a functional form of organization, and as the duty of a manager is to operate his undertaking to the best advantage within the framework of a policy laid down perhaps wholly or partly without his control, I felt that my experience in this field could be of interest to those engaged, or about to be engaged, in this intangible thing called management.

" Functionalism," explained the author, " can be achieved by dissecting the work carried out in an undertaking into units of activity, by integrating all like units, and by placing the responsibility for the efficient execution of each group of activities so integrated in the hands of a single specialist. The principle is applicable to any undertaking, irrespective of its size ; in larger concerns the consequent size of the work within a function may mean the appointing of lieutenants to overlook sections of a function, the sections being determined either sub-functionally or on geographical or numerical bases. The essential is to have one executive, and one only, responsible to the higher management for the welfare of the complete function. In smaller concerns there will usually be no question of establishing sections, and, in fact, it may well be that one executive may be held responsible for more than one function. This is still functionalism, as the requirement of single responsibility is satisfied, but the smaller undertaking must suffer the handicap of finding it uneconomic to employ a specialist to control each functional group of activities."

A Lively Discussion

There was pertinent discussion on this paper—a resounding broadside from big guns. The paper is substantially given in to-day's " JOURNAL." Our report of the discussion will be published next week.

Sir Charles Darwin, M. M. Trechsel, Sir Frederick West and Mr. A. E. Sylvester.

Mr. R. Lishman, Sir Andrew McCance, the Dowager, Lady Nunburnholme, Col. H. C. Smith, and Mr. C H James.

The Benevolent Fund

After Mr. Leach's paper the meeting adjourned for a general meeting of the contributors to the Benevolent Fund of the Institution (see page 671). On resumption of the Institution meeting Mr. H. J. Escreet, Distributing Engineer of the Gas Light and Coke Company, presented his paper, "A Survey of Gas Distribution Practice."

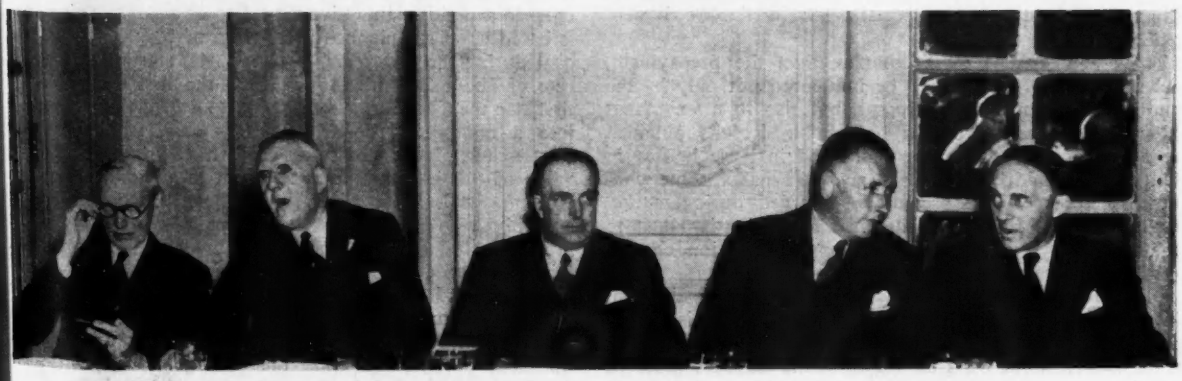
Distribution

Mr. Escreet's contribution reviewed the present state of distribution practice in the British gas industry, and included a section on the design of distribution systems for complete domestic service by gas. One part of the paper dealt with the development from simple low-pressure distribution systems to feeder-main systems, and with high-pressure systems for rural areas. The development and control of grid sytems were described, and reference was made to the importance of district storage and peak-load plant at outlying stations for improving the load factor on large grids. The distribution systems of several gas undertakings were described and illustrated, and the principal statistics relating to them were given. A further section of the paper dealt briefly with pumping plant, and another with the relative merits of high and low pressure storage for outlying holder stations. The various types of pipes available for main laying were described, and reference was made to the uses of steel, wrought iron, and copper tubing for services. A few notes on main laying practice and the use of mechanical plant for that purpose were included.

The last section of the paper was concerned with the problem of supplying a domestic load some eight to ten times above the present average demand, as would be required if gas were to be used for supplying all domestic heating requirements, including a high standard of space heating. The costs of mains, services, &c., for local distribution for a diagrammatic lay-out of a town of 10,000 houses were worked out both for normal loads of 150 therms per consumer, and loads of 1,200 therms per consumer per annum, and it was shown that the total costs per therm, for transmission and local distribution, would be much reduced if this high demand per consumer were attained. This reduction in cost is largely due to the high standard of house heating which results in gas being used continuously night and day, for a large part of the year, and gives a much improved load factor compared with normal space-heating practice.

Further Survey

Two papers constituted the technical part of the business session on Thursday morning, June 10. The first was by Mr. Stirling Everard, of the Gas Light and Coke Company, and it had the somewhat formidable title: "A Survey of the Uses of Gas for Domestic and Industrial Purposes, together with Factors Influencing Future Trends." Mr. Everard sought to demonstrate that the commercial policy of a gas undertaking must be attuned to the conditions on the district, and must respond to changing circumstances. To-day the emphasis is upon working-class housing, and the business is tending to lose its "retail" characteristics, for more and more it is the local authority which decides, in advance, the apparatus to be installed, by placing orders for the equipment of houses or flats by the dozen or by the hundred, the consumer accepting what he is given. It is in an undertaking's interests, therefore, to have as precise information as possible about the factors influencing consumption, so that accurate forecasts can be made before tendering to equip new estates. Similar information is also invaluable in deciding policy in respect of existing consumers. The Gas Light and Coke Company has devised its own market research technique for the study of these problems, and this is outlined, but data have also been provided for the paper by the Birmingham Gas Department, the Bournemouth Gas and Water Company, the Newcastle-upon-Tyne and Gateshead Gas Company, and the Swindon United Gas Company. Company.



Sir Harry Lindsay, Mr. G. G. Williams, Mr. C. Dinsdale, Mr. C. H. Chester, and Sir Guy Nott-Bower.

The demand by the consumer for heat, said Mr. Everard, is determined by certain definable factors, and the share of this demand obtained by the gas industry is also dependent upon certain factors which are not wholly within the control of an undertaking. Particular attention is paid in the paper to the analysis of the prepayment load. The load obtainable in any given household is determined by the number of persons in the household and the number of rooms in the dwelling, but the results actually obtained will be dependent upon the apparatus installed and the standards of living of the district. Average results from old, "intermediate" and newly developed districts in the Gas Light and Coke Company's area are considered, followed by the examination of results from specific streets in Birmingham, and a comparison between old and pre-fabricated dwellings in Newcastle-upon-Tyne. The range of consumption within a given grouping is recorded for both Birmingham and Newcastle, and a tabulation of consumers in different areas, grouped according to number of persons and rooms, is given.

The relatively poor equipment of the average "prepayment" home makes interesting comparison with the standard now required, and suggests a very much higher consumption per consumer in the future when rehousing has made more progress, but regard must be paid to the load factor of new business. This tends to be very much better for prepayment supplies, where the ratio of persons to rooms is high, than for credit, where the ratio is generally considerably lower. This may be held to justify special tariffs for the prepayment load.

The credit load is more complex than the prepayment, and the demand for gas will be influenced not only by the number of persons and of rooms, but also to a very great extent by the income of the household. Results obtained in blocks of flats in Bournemouth and in large houses in Bournemouth and Swindon are given. Finally, some consumer preferences and prejudices, recorded during market research surveys, are discussed, and the question is put as to whether to-day's apparatus prices and installation charges could not be reduced.

The non-domestic load requires analysis along different lines to those appropriate to domestic business, and is subject to fluctuations due to the state of trade, not so apparent in the latter. Each class of non-domestic business must be examined separately. Attention is paid to the quasi-domestic load, such as boarding-houses and hotels, and central services, in which comment is made on the "waste" factor inherent in unmetered hot water supply. Restaurants and canteens are dealt with as adjuncts to domestic and industrial business and farms are touched upon. Industrial process loads show irregular characteristics, but when aggregated these are reduced by reason of diversity.

In conclusion, the characteristics of any load are determined by the space-heating content, which must always be taken into account in framing commercial policy. The paper does not attempt to define what this policy should be, but, rather, to set out methods for examining the various loads as a guide in reaching decisions; but it would appear that, under to-day's conditions, the prospects of the industry for increasing its load in the coming years are excellent.

British Gas-Making Coals

The final paper at the meeting was by Dr. J. G. King, Director of the Gas Research Board, who explained that quantitative data regarding the reserves, and probable rate of production, of the different types of coal available in Great Britain have emerged from the work of the Regional Valuation Boards of the Ministry of Fuel and Power and of the Regional Coal Survey Committees. The careful examination of the details of the work of the former by the Fuel Research Survey Officers has, with their accumulated knowledge of the physical and chemical properties of the coal in British seams, enabled a rapid quantitative survey to be made. This survey is based upon the planned production of 20,500 mill. tons of coal during the 100 years, 1942 to 2042, starting at a yearly rate of about 240 mill. tons during the first decade. As a first step the Coal Survey officers have divided these quantities into a number of defined types of coal, while the more detailed examination of other properties is proceeding. The value of this information is apparent to all industries which consume coal, but particularly to those which can operate at a higher level of efficiency if supplied with coals whose properties fall regularly within certain definable limits. Dr. King's paper deals with the reserves, future supplies, and distribution of the types of coal which are most suitable for gas manufacture by existing processes. Whether all such reserves can be allocated to the gas industry is an important question, particularly since the coking industry in some districts is interested in the same types of coal.

Of the defined types of coal, those considered by the author to be suitable for gas manufacture amount in total to 46·0 and 15·6 mill. tons of "first" and "second" choice coal, or to 52·7 and 17·3 mill. tons at the higher annual rates of the first 10 years. These quantities represent 2·0 to 2·5 times the 23 mill. tons of coal now treated by the gas industry. The choice is based on type of coal only, but of the selected types certain amounts may be unsuitable in size or ash content. With increased attention to coal preparation and the introduction of standard size grades it should be possible to increase the availability of these unsuitable types.

The proportions of "first-choice" coals in the different coalfields are subject to some variation with time, but the general conclusion is that they will remain substantially unaltered during the review period of 100 years. The exceptions are Durham, where the working out of the coking coals may reduce the amount of coking/gas coal available to the gas industry; West Yorkshire, where there will be a slow decrease in the caking power of the coal; and North Staffordshire, where the proportion of gas-making coal is planned to increased by 20% during the next 10 years. These exceptions can no doubt be adjusted, and an enforced changed in the type of gas-making plant installed in any area is not forecast. It seems probable, however, that considerations of the transport of coal (including cost) will influence the choice of new plant in the direction of installing plant suitable for the coal most readily available. The distribution factor is discussed in terms of coal quality, the areas of coal production, and the boundaries of the areas projected by the Gas Bill.

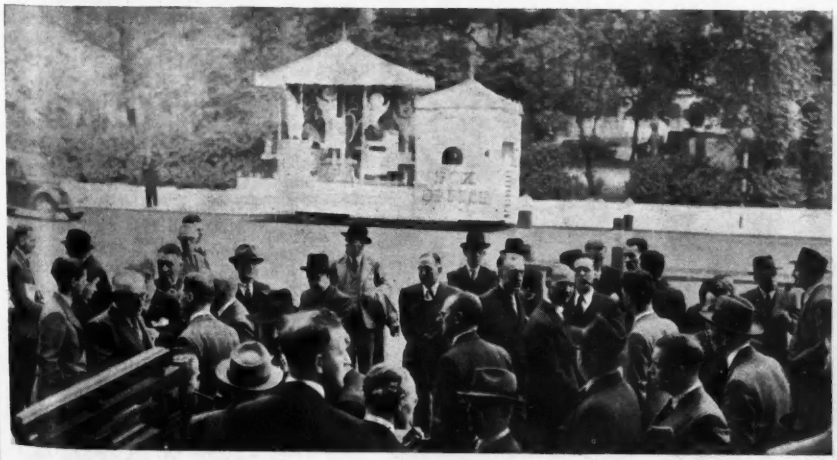
The review is made in terms of existing processes of gas manufacture which require coal having a caking power above a certain minimum level. The introduction of a new process which would treat coals having a caking power below this minimum would make available much larger reserves of coal. This is true, said Dr. King, of the experimental method of complete gasification now the subject of research by the Gas Research Board. It is already indicated that non-caking bituminous coals of either high or low volatile matter would come within the class of gas-making coal should this research eventually lead to the development of an actual process. While the stage which development has reached is not sufficiently advanced for consideration of coal requirements, it is interesting to speculate upon whether the method might gasify the low-volatile coals of Kent and South Wales. If this were found to be possible, it would have an important bearing not only on the development of the Kent coalfield, but also on London's requirements for gas coal.

Votes of Thanks

Mr. T. F. E. Rhead (Birmingham) proposed an omnibus vote of thanks to the Representatives from Overseas, the Society of Friends, the Gas Light and Coke Company, the British Oxygen Company, Ascot Water Heaters, Ltd., the South Metropolitan Gas Company, J. Stone & Co., Ltd., the Telegraph Construction and Maintenance Co., Ltd., the Watford and St. Albans Gas Company, ladies and gentlemen assisting in the conduct of the meeting, the authors of the papers, the Scrutineers of the ballots, the Officers, Auditors, Council, and Committees of the Institution, and the Secretary and staff of the Institution. The vote was carried with acclamation.

The Secretary (Mr. W. T. K. Braunholtz) replied briefly to the vote of thanks to himself and to the staff of the Institution.

Mr. E. Crowther, in proposing a hearty vote of thanks to the President, Dr. Harold Hartley, said there were so many things which one could say and which should be said about the excellent manner in which he had discharged the duties of his office during the past 12 months that difficulty was experienced in selection. It was a vintage year in the record of the Institution's Presidencies. Dr. Hartley's loyalty to the Institution and his faith in its future had shone out from all of his remarks and activities through the year, and had been a refreshment and inspiration to everyone. His high technical ability and that happy blend of science and sanity, together with a great deal of humanity, had been an encouragement and incentive to those concerned with the advancement of the industry. It was a source of great gratification to members that during his year of office Dr. Hartley should have been nominated the Deputy Chairman of



A new decorated van, designed by the Gas Light and Coke Company for use at carnivals and similar functions, caused considerable interest when it parked opposite the main entrance of Friends House.

the Company which he served, and members would be unanimous in congratulating both Dr. Hartley and Radiation Ltd. on their most happy choice.

NEW MEMBERS OF THE INSTITUTION

The following were elected as a result of the ballots declared at the opening session of the annual meeting of the Institution of Gas Engineers on June 8:

Honorary Members

The presidents (*ex officio*) of the Gas Associations of Australia, Belgium, Canada, Denmark, France, The Netherlands, New Zealand, Norway, Sweden, Switzerland and United States of America.

The president (*ex officio*) of the Coke Oven Managers' Association.

Falmouth, The Rt. Hon. Viscount, B.A., C.I.E.E., M.I.Mech.E., President, Gas Research Board.

Members

Barker, H. P. (Parkinson and Cowan, Ltd., London).
Birchmore, D. L. (Louth).
Blackhurst, G. (Lanarkshire County).
Chalmers, E. V. (Peterhead).
Dann, H. N. (Blackburn).
Dickie, J. K. (Colvilles, Ltd., Glasgow).
Donnelly, R. P., M.A., B.Sc. (Government of Western Australia).
Duffy, J. J. (Dundee).
Filer, S. L. (Tredegar).
Fuidge, G. H., B.Sc. (South Metropolitan).
Gowan, A. A. (Shanghai).
Grieve, T. F., B.Sc. (Lanarkshire County).
Griffiths, G. (Bradford).
Hird, W. T. (Sheffield).
Howarth, G. B., M.Sc. (Department of Mines, New South Wales).
Hurdman, W. L., M.Sc. (Parkinson Stove Company, Ltd., Birmingham).
Illingworth, H. S. (Hemsworth and United Kingdom Coke Oven Co., Ltd.).
Jones, C. B. (Cowes).
Kingsbury, W. H. (South Metropolitan).
Marshall, J. R. (Notts and Derby Coke and By-product Co., Ltd.).
Martindale, J. R. (Neepsend, Sheffield).
Mills, F. E., B.Sc. (Gas Light and Coke).
Parsons, W. K. (Rhos, Johnstown).
Partington, H. (Rochdale).
Reid, E. C. J., B.Sc. (Gas Light and Coke).
Ruggles, R. C. (Radcliffe, Farnworth and District).
Smith, J. P. (Sawer and Purves, Manchester).
Taylor, H. B. (West Riding Group, Wakefield).
Watkinson, C. (S. Fox & Co., Ltd., Stocksbridge).
Whitehead, P. J. (Swindon).
Wilkinson, A. (Huddersfield).
Williamson, R. (Sunderland).

Associate Members

Ames, B. W. (Peterborough).
Andrews, J. O. (Tottenham).
Banyard, C. W., B.Sc. (Lincoln).
Beale, E. W. (Birkenhead).
Bedford, G. F. (Gas Light and Coke).
Beilby, G. W. (Mossley and Saddleworth).
Blenkhorn, T. H. (Blackburn).
Brooks, J. E. (Blackpool).
Burch, G. A. (Gas Light and Coke).
Butlin, W. N. (Evesham).
Campbell, I. (Coatbridge).
Cooke, J. O., B.Sc. (London and Counties Coke Association).
Cornock, J. S. (Ayr).
Cranmer, A. G. (Willenhall).
Crudgington, C. S. (Robert Dempster and Sons, Ltd.).
Cummings, W. (Newcastle-upon-Tyne).
Deeks, J. M. (Ryde).
Dennis, E. S. (Colchester).
Duxbury, A. D. (Leeds).
Elles, H. C. (Manchester).
Foster, H. (Oldham).
Gilchrist, W. (Kilmarnock).
Godley, J. F. A. (Brighton, Hove and Worthing).
Goodwill, J. L. (Dudley).
Hargreaves, H., B.Sc. (Sheppy).
Hart, R. V. (South African Lighting Association).
Hayward, W. G. (Gas Light and Coke).
Heggie, W. G. H. (Dundee).
Henry, J. A. (Loughborough).
Howell, W. F. S. (Manchester).
Jenks, F. R. (Birmingham).
Kershaw, J. (Darwen).
King, L. F. (Fletcher, Russell & Co., Ltd.) (Radiation).
Kleist, L. L. (Cardiff).
Laycock, K. E. (Bradford).
Locke, L. W. (Teignmouth).
Lockett, R. (Rochdale).
McIntyre, J. (Stockport).
Mann, L. V. S. (Birmingham).
Manning, C. W. (Bristol).
Martin, H. (Portsmouth and Gosport.
Mather, L. R. (Halifax).
Middleton, G. J. (Cambridge).
Mitchell, A. R. (Newcastle-upon-Tyne).
Mitchell, J. V. (Burnley).
Moore, M. J. (Tottenham).
Morris, J. E. (Redditch).
Nicholls, P. N. (Worcester).
Parker, F. (Bradford).
Parry, E. I. (Liverpool).
Perriss, C. E. (Croydon).
Philip, D. (Henry Balfour & Co., Ltd., Leven).
Pipe, P. D., B.Sc. (Tottenham).
Pringle, T. G. (Edinburgh).
Pursey, L. N. W. (Exmouth).
Randall, R. C. (Leamington Priors).
Rhodes, R. P. (Gas Light and Coke).
Robinson, H. E. (Radiant Heating, Ltd.).
Rodley, A. (Gas Light and Coke).
Saville, G. R., B.Sc. (Liverpool).

Scholefield, D. A., B.Sc. (Gas Research Board).
Searle, A. F. (Bournemouth).
Silvey, G. A. (Uxbridge, Maidenhead, Wycombe and District).
Simpson, E. (Burnley).
Smith, B. C. (Middlesbrough).
Smith, R. B. J. (Bath).
Smith, R. B. (Northwich).
Stanford, L. F. H. (Uxbridge, Maidenhead, Wycombe and District).
Stanger, R. H. (South Metropolitan).
Steel, J. E. (Croydon).
Thurley, R. J. B. (South Suburban).
Twyman, C. E. G. (Isle of Thanet).
Vick, D. O. (Watford and St. Albans).
Walshaw, A. E. (Bury).
White, J. W. R. (Spenborough).
Wilson, N. D. (Perth).
Wizard, A. J. (Gas Light and Coke).
Wood, G. C. (Dunfermline).

[A list of the Associates of the Institution elected on June 8 will be found on p. 713.]

DANGERS CONFRONTING THE GAS INDUSTRY

WARNINGS BY COLONEL W. M. CARR

COLONEL W. MONCRIEFF CARR, O.B.E., T.D., the Chairman of the United Kingdom Gas Corporation, addressed managers of the Corporation's controlled undertakings at a luncheon at Grosvenor House, London, on Thursday, June 10.

Colonel Carr particularly welcomed the opportunity to meet the managers of the undertakings, for he was afraid there might not be many such opportunities in the future; he was glad to express his thanks for their loyal co-operation and for the great work they had done in the development of the Corporation they were all so proud to serve. They had by no means achieved all they had hoped to achieve, but in the 13 years of the existence of the Corporation they had achieved a great deal; it was true to say that it was nearly all achieved during the four years of its existence before the war. He had appreciated their loyalty and the way in which they had accepted their responsibilities; and he hoped that when nationalization was effected, as it now appeared to be effected, they would be given the same scope and similar responsibilities and would be enabled to develop their individuality. Indeed, it must be so, because if the gas industry forgot its primary purpose of providing cheap and abundant supplies of gas and coke, that would be nothing short of a national disaster.

A Cause for Alarm

They were working under ever-increasing handicaps, due to an increase in costs, the most important of which was the increased cost of coal. One viewed with alarm the report that the Coal Board had lost a sum of £40,000,000 in the last year. That sum had to be provided; and by whom? By all of them. Whether it was to be a direct cost on industry or whether it would be raised by increased taxation he did not know, but it had to be met; and he did not believe any country could face such appalling losses. Therefore, he hoped that in the new structure the authorities would not do as was done in the case of the coal industry and start by establishing an organization with no set function, like a builder starting to build a house by constructing the roof first. In any case there was no excuse for neglecting the elementary principles of planning on the basis of the materials with which one had to build. If one made plans on paper for the organization of industry, those plans must be based upon what existed. "By all means try to make improvements," he said, "but do not break down the structure of control and management and administration." Again, it was dangerous in any industry to introduce inexperienced administrators in permanent positions at the highest level. After all, those responsible for various undertakings would appreciate that from the time they started they were learning, so that they became able to form better judgments than formerly, to plan better, because of the knowledge they had gained by experience He certainly hoped that under the new arrangements in the case of gas there would be no appointments of people to control the industry who had not proved their efficiency, who had not had experience in the conduct of that industry. The organization of the Corporation as it existed to-day could not afford to carry them. But the public had one great safeguard, that those in the gas industry had to make the industry pay, and they could only make it pay by giving the best and cheapest service possible. That had been their first and foremost task; it would have to be the same under nationalization.

Colonel Carr emphasized that the individual on the spot in any given area must be responsible for the results of the operation of his undertaking, and if he were successful he must be given credit for it. Although they worked to earn their living, they worked also for something much more than that—for their interest in the job. The United Kingdom Gas Corporation had been successful because the job was the first consideration of those concerned in it, and because they knew that the good work they did would not be passed by, but would be seen and appreciated. Those considerations were fundamental to the structure of any industry; the prosperity of Britain had arisen because of the responsibility and initiative of the individuals.

A Fine Achievement

The United Kingdom Gas Corporation had probably done far more in integration than had any other gas organization that existed. The West Yorkshire Distribution Company was the first of its kind. The amateur planner would urge that that sort of

Among the few ladies present at the Institution meeting were Mrs. W. M. Buchanan, Organizing Secretary, and Miss Maywen Godby, Technical Adviser to the Women's Gas Council.

thing should be done everywhere in the country. But that would be impossible, except in places where the conditions were the same. Recalling the investigations that were made at the time the West Yorkshire grid was constructed, he said they had estimated the potential loads, particularly the industrial load; careful surveys were made over a long period; no undertaking was connected to the grid until it was proved that the cost of gas would be reduced by bringing that undertaking within the ambit of the grid. If it were uneconomic, as was the case with certain outside undertakings, no connexion was made. That was why the scheme had been successful.

If they substituted ideological and political ideas for the strictly economic principles on which the present prosperity of the gas industry had been built, they were making a very serious error. The test of success would be the prices at which the products of coal carbonization were offered to the public and to industry. If prices stayed down, then nationalization would have succeeded; if control of costs and prices were lost, the industry would founder. Price was of vital importance; the cost of gas was a basic cost, affecting wages and affecting industry.

The ultimate consumers of gas and coke were not only those living in this country, but those living overseas who bought our exports and sent us our food and raw materials in exchange. Those overseas customers were free to buy where they chose, and if our export prices, including as a significant element the price of gas, were not competitive, our overseas sales would languish and our standard of living would fall. It was thought that, because competition was done away with between fuels and because we were having a general levelling up, price did not matter; but it mattered all the time. Day by day it was necessary to appreciate exactly what was spent, and what the effect of that spending was going to be on the cost or the price to the consumer. That must remain the basic consideration. There had been no hesitation to provide facilities for modernizing the undertakings within the ambit of the Corporation; there had been no hesitation to sacrifice dividends in order to improve working results. That was the right long-term point of view. After all, the real asset was the goodwill of the consumer, without which the works and mains were of no value whatsoever.

He hoped that under nationalization the managers of the respective undertakings would not be called upon for any more returns than were called for by the United Kingdom Corporation; but he was afraid they would. He hoped that the new structure would be such that it would provide for de-centralization not less than the de-centralization which had been provided in the United Kingdom Corporation.

Frustration

Colonel Carr also pointed to the dangers inherent in competition between the National Coal Board and the gas industry for control of the nation's coke ovens, which were really an integral part of the gas supply system. Leaving the coke ovens under two separate authorities would lead to overlapping of effort, avoidable delays, and increased costs. There was provision in the Bill, in connexion with negotiations between the Coal Board and the relative Area Boards, for the interchange of planning for development. In those Areas in which the Coal Board was at present high and mighty, under the terms of the Bill as it stood at present the gas industry was obliged to submit its schemes of development to the Coal Board. In the past the industry had bought gas from the coke ovens on terms which had made it economic and beneficial to the consumers. But now there was a change of plan.

To illustrate the sort of delays which would arise in respect of urgent and vital developments through having to pass through vast organizations like an Area Gas Board and the Coal Board in London, he recalled that the West Riding of Yorkshire group of gas companies during the war had looked forward to the problems of serving industry after the war, and had agreed to make available supplies of gas to the extent of no less than 7 mill. cu.ft. per day. It was proposed to put down a big station at Upton in conjunction with Messrs. Dorman Long to carbonize the whole of the output of the Upton Colliery. It was a magnificent scheme; it had meant that the colliery would have received a little more for its coal, and that the coal would be made to go twice as far as it would if used in its raw state; it would have fitted into the grid scheme, and supplies would have been available to industry. Unfortunately, when everything was ready to go ahead, nationalization of coal had taken place.

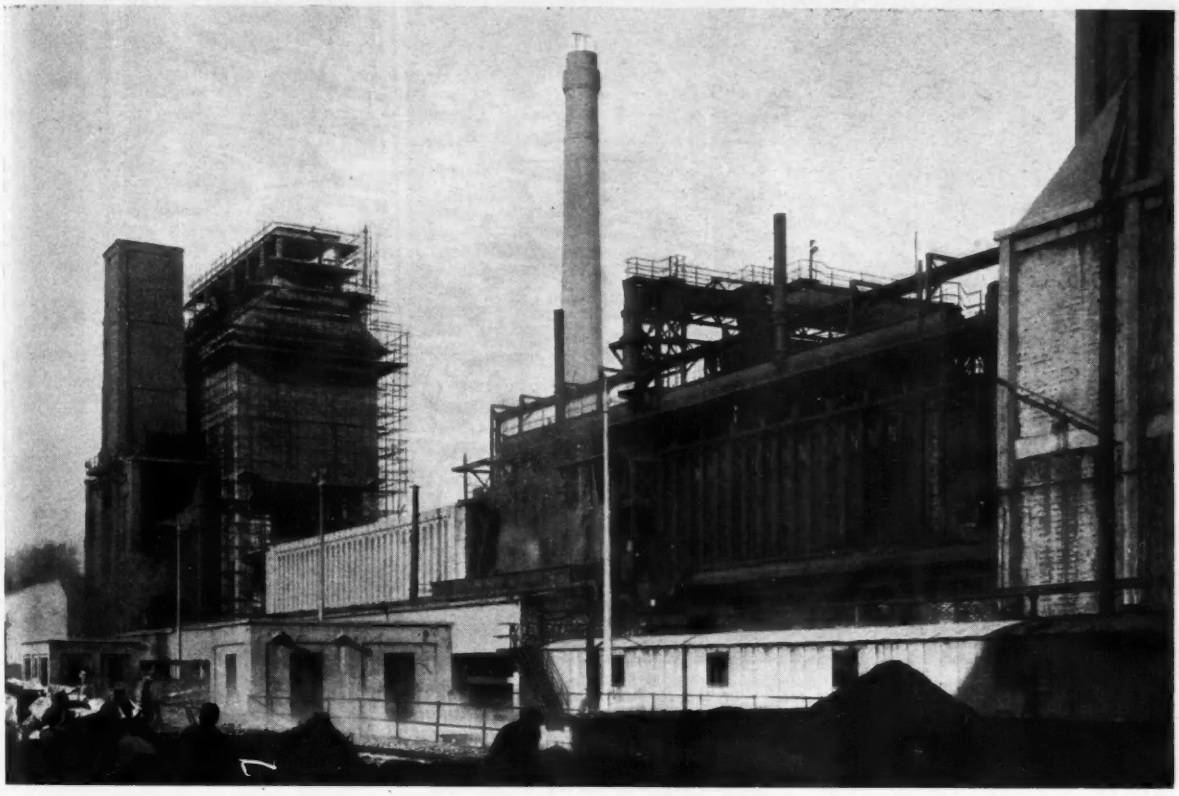
He had no power to build gas-works, and a Bill was introduced into the 1945-46 session of Parliament to give powers to build works. By the time those powers were obtained, the Coal Board had been vested, and he had visited Lord Hyndley, pointing out that the original scheme was very much better than the alternative scheme that had had to be adopted because of coal nationalization. Colonel Carr had emphasized that he had the organization and the technicians, and he had asked to be allowed to build coke ovens for the Coal Board, for he wanted the gas. By then the Coal Board had set up a new office and he had approached the new Director of Carbonization; and the matter had had to wait for the decision of the Minister or someone at the head. Eventually, in January of the following year, he had received a reply; the Coal Board were considering erecting coke ovens in the West Riding, and when those ovens were built they would be pleased to give him a supply. The supply from Upton, however, was the only supply that was of any use to him, and in the meantime he had had to go on with the alternative scheme.

The appointment of a Chairman and a Deputy-Chairman had been made for the Gas Council, and he hoped there would not be interference to any appreciable extent with the operation of the Area Boards. If the Chairmen of the 12 Area Boards were all men well experienced in the industry, he did not think there was need to fear very greatly that the structure would not be good; equally, he hoped the appointments to those Boards would be of experienced people, that there would not be dictation, but that there would be full delegation of responsibility throughout the whole industry.

To the managers as individuals, he said he hoped they would not lose heart by reason of the somewhat gloomy picture he had painted. If they displayed the spirit of initiative which they had displayed in the conduct of the business of the United Kingdom Gas Corporation they would not fail.

The meeting successfully concluded, the Secretary, Dr. W. T. K. Braunholtz, leaves Friends House. As recorded in our Personal column, Dr. Braunholtz has been awarded the O.B.E.

BECKTON : ROTHERHITHE : ST. ALBANS



On Wednesday of Institution Week one of the visits was to the Beckton Works of the Gas Light and Coke Company. Many of those who participated well remembered the official visit in 1932, the year when coke oven plant became part of the carbonizing plant of the world's greatest (and, rightly, world famed) gas-works. The 1932 coke oven plant has been in continuous operation since then. To-day, at Beckton, coke ovens (the backbone of New Beckton) are being installed on a scale commensurate with this vast undertaking so magnificently conceived, by Adams Beck. The hospitality on Wednesday last was traditional and the appreciation of 250 visitors was voiced by Mr. S. E. Whitehead in reply to the welcome by Mr. Michael Milne-Watson, Governor of the Company.

THE extension of plant at the Beckton Works of the Gas Light and Coke Company includes the construction of several batteries of coke ovens. Two Koppers batteries, opened in 1932, are still in operation and one of the two new batteries, now almost complete, will be lighted up in June; the latter are W-D Koppers ovens with ancillary plant and a mechanical producer plant, and the battery comprises 30 ovens of 39 ft. 1¾ in. by 14 ft. 1½ in. by 1 ft. 5¾ in. with a taper of about 1⅜ in. from the machine side to the coke side. The daily throughput of coal will be of the order of 600 tons, yielding approximately 8 million cu.ft. of gas. Owing to the nature of the site the foundations required special precautions, and piles of 40 ft. length had to be used each able to bear a load of about 40 tons. These piles are capped with a 2 ft. thick concrete raft suitably reinforced to distribute the weight equally.

The coal charging car with a capacity of 850 cu.ft. carries a hopper which is divided into three sections fitted with telescopic drop sleeves. An Avery scale which is provided weighs the coal before charging, a process which takes approximately 2½ minutes. The reinforced concrete coal bunker over the ovens has a capacity of 3,900 tons and is fed by a conveyor belt system at the rate of 200 tons an hour. On the machine side the combined door-lifting, coke pushing, and coal levelling machine is of the portal type, the whole combined machinery being mounted in one frame where each has its own motor. On the discharge side the quenching car has a capacity of 13 tons of coke and the discharging operation takes 4 minutes. Each oven holds 17½ tons of coal and at a normal carbonizing period of 21 hours has a throughput of 20 tons every 24 hours, but the minimum period is 19 hours. Each oven has double gas offtakes with brick linings. The heating chambers are designed as hairpin flues with waste gas recirculation. Each oven has its own regenerators which are arranged in pairs on either side of the central division walls so that alternate regenerators on one side will be preheating ingoing producer gas and secondary air respectively, while the chequer fillings of those on the other side will be recovering heat from the waste gases in their passage to the main flue. The flow through the regenerator is reversed every half-hour so that those which have been receiving heat from the waste gases are able to release their stored heat to the producer gas and air. When coal gas is used for heating, both chambers of the regenerator are used for air heating.

A combined coke guide and door extractor machine is installed on the discharge side of the battery for the removal of the oven doors and for guiding the hot coke into the quenching car. When quenched, the coke is discharged automatically on to an inclined coke wharf to allow surplus water to evaporate. By suitable adjustment of the quenching time, which varies usually between one and one and a half minutes, the moisture content of the coke can be regulated. The wharf holds five charges and the time allowed on the bench is 40 minutes per charge. At the end of this period the coke is removed through gates to a belt conveyor and carried to the main screening and grading plant. The quenching tower is about 125 ft. high and houses two water tanks each of 7,500 gall. capacity filled by two 30,000 gall. per hour quenching water pumps.

The gas from the battery passes to the condensers through a collecting main flushed with liquor. The condensers comprise three multi-pass vertical water tube units which cool the gas to a temperature of about 60° F. A pressure type sand filter is installed in the water circuit prior to the condensers, to obviate fouling of the heat transmission surfaces. The reversing of the gas flow through these condensers is effected by pneumatic power operation of the 36 in. gas valves.

From the condensers the gas passes to one of the two motor-driven turbo-exhausters, which are controlled to maintain a constant suction on the condensers by an Askania regulator. From the exhausters the gas flows under pressure to an electro-static detarrer having an extraction efficiency of over 99%. It is then washed for naphthalene in two rotary six-bay washers. These washers are normally worked in series and are followed by a secondary condenser where the gas may be recooled to a temperature of 60° F. by water before passing via a second electrostatic detarrer to two 12-bay rotary ammonia washers. These washers are arranged to operate in parallel and are supplied with cold water for washing in the last three bays, and cooled ammonia liquor from the flushing liquor system is used in the first

General view of the No. 1 retort house setting at the Rotherhithe Works of the South Metropolitan Gas Company, visited on Thursday by the President, Dr. Hartley, and about 150 members of the Institution. Dr. Hartley, at tea, voiced the thanks of the visitors to the Directors, Executives, and Mr. T. A. Canning, Engineer and Manager. Dr. E. V. Evans, Managing Director and a Past President of the Institution, who replied, expressed the Company's pride in its "last word" in horizontal retorts, and the latest addition to its fleet, the first step towards integration in that it is capable of the "tricky business" of going up-river as far as Wandsworth.

nine bays, this liquor being delivered via a rack cooler. A naphthalene stripping plant will be provided for dealing with the rich oil from the naphthalene washers.

No. 3 battery will be heated by a mechanical producer plant which has been built on to the house supplying Nos. 1 and 2 batteries. Four producers, each of approximately 9 ft. 6 in. internal diameter, of the W-D Koppers type will supply the battery with gas, but five more will be added when constructing No. 4 battery. The hot gas from the producers will pass through washer scrubbers, each capable of dealing with 125,000 cu.ft. of gas per hour. Next, the gas will go through an electro-filter with a capacity of 4 million cu.ft. a day and an efficiency of at least 95%. Oil evaporators or vaporizers made in the Gas Light and Coke Company's own workshops are installed for vaporizing the oil into the gas stream prior to the electro-filters. Clean gas from the electro-filters will go through combined gas exhausters and air blowers which will boost it to the ovens and to the relief holder. The exhauster will be capable of dealing with over 1,300,000 cu.ft. of producer gas per hour.

Coke ovens by the Woodall-Duckham Company.

Coke ram and attached machinery by the Wellman Smith Owen Engineering Corporation, Ltd.

Condensers by Whessoe, Ltd.

Exhausters by British Thomson Houston Co., Ltd., and the Pulsometer Engineering Co., Ltd.

Detarrers by Whessoe, Ltd., and Woodall-Duckham Company.

ROTHERHITHE RECONSTRUCTED

In 1939 the first part of a large scheme of reconstruction was commenced by the installation of new horizontal carbonizing plant in No. 2 retort house. Immediately following the close of the war in 1945 it was decided to embark on the more ambitious section of the reconstruction programme, which included a new horizontal carbonizing unit in No. 1 retort house and the modernization of the whole of the wet purification plant with ancillary developments necessary to deal with the increased make of gas. During the course of this work the plant in No. 2 retort house has continued in operation and the new units of plant are brought into commission as they become available for use.

The carbonizing plant is accommodated in two retort houses. Each retort house contains two sections of 10 settings, 10 retorts to a setting, arranged in vertical columns of five. The retorts are of the segmental type, oval in section and made of Derbyshire silica material. Retort dimensions are 21 in. by 15 in. section by 20 ft. long. In-built producers are provided, one to each setting.

No. 2 retort house contains an installation of modern horizontal carbonizing plant which was put to work in 1943. In this house both sections are heat-insulated, the system adopted being that of enveloping each section with its waste gas flue. By this means the products of combustion are conducted over and under each section before being led away to the waste heat boilers. On a 10-hour carbonizing period each boiler generates 8,000 lb. of steam per hour at 150 lb. per sq. in. The reconstruction scheme at present in progress provides ultimately for the fitting of superheaters to these units.

The No. 1 retort house installation is a later development and the section at work in this house commenced gas-making in August, 1947. In these units the waste gases pass over the tops of the sections only and are conducted from there either to the chimney or to the waste heat boiler as required. This boiler serves to balance the steam requirements of the works, the output of steam and its degree of superheat being automatically controlled by mechanically operated dampers.

Retort scurf is resctricted to a minimum by aeration under conditions of natural draught. The average weight of charge is 13.20 cwt., but to maintain this figure and, at the same time, to provide a regular retort aeration programme entails a maximum weight of charge approaching 14 cwt. The standard carbonizing period is 10 hours and an average production of 115 gaseous therms per retort per day is obtained consistently. A yield of 73.50 gaseous therms per ton of coal carbonized is averaged under all conditions, and coke and breeze made for sale (calculated on the same basis) approximates to 11.0 cwt. Fuel consumption in the producers is of the order 16-17% before any allowance is made for steam recovery in waste heat boilers.

Coke is pushed from the retorts by means of hydraulically-operated discharging machines, and the Le Fleuve system of coke quenching and conveying is employed.

All settings are equipped with scrubber standpipes. In No. 2 retort house the mouthpieces are fitted with 6 in. diameter offtakes delivering into standpipes of internal section, 12 in. by 6 in., the whole of this equipment being in cast iron. The installation in No. 1 retort house demonstrates an entirely new departure in scrubber standpipe design. The equipment is fabricated in welded mild steel and the offtakes are 3 in. in diameter while the cross-sectional dimensions of the standpipe have been reduced to 6½ in. by 5 in. The use of the

smaller offtake pipe permits the design and use of augers lighter in weight and less difficult to manipulate than those used hitherto, with corresponding advantage to plant operatives.

In all standpipes gas flows counter-current to liquor sprayed from a jet situated at the top of each pipe. The rate of liquor delivery is 100 gall. per hour on each standpipe and the resultant tar and liquor overflows through foot seals located at the base of each standpipe to separator tanks from which tar gravitates to the storage tanks. Liquor of high fixed ammonia content is drawn off for circulation in the ammonia washers and "make-up" liquor for the standpipe system is derived wholly from condensates of low fixed ammonia content derived from the primary gas coolers.

Retorts are maintained under constant and steady pressure conditions (10/100 in. W.G.) by means of Askania regulators with control rooms at stage level.

The coolers, two in number, are of the open top, vertical water-tube type, constructed from welded mild steel and have been supplied by Whessoe, Ltd., of Darlington. Each unit comprises eight gas and water passes arranged to give counter-current flow and contains 1,280 tubes of 2 in. internal diameter and 20 ft. long. All surfaces in contact with water are galvanized.

Each of the two coolers is capable of handling the summer gas load—*i.e.*, 7.2 million cu.ft. per day of gas measured at 30 in. Hg. and 60° F.—and is required to cool the gas (saturated with water vapour) from 85° C. to 35° C. Under conditions of winter gas load—*i.e.*, 9.6 million cu.ft. per day—the coolers will operate in parallel.

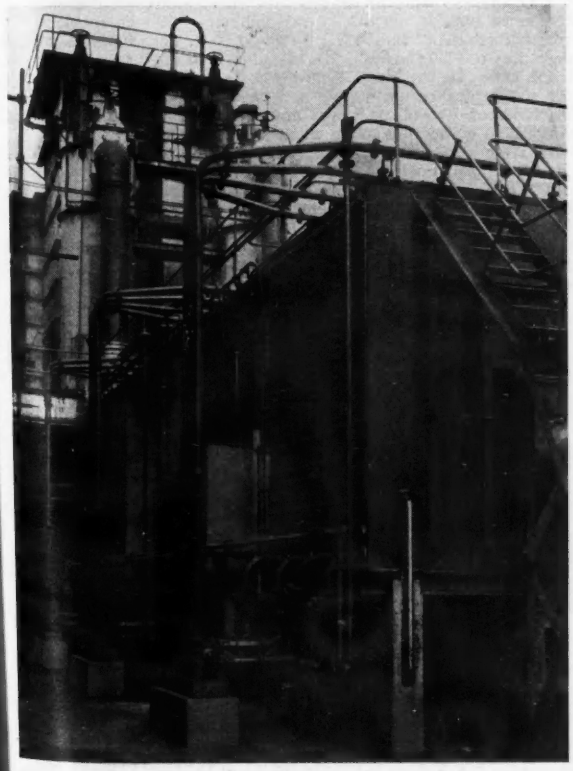
The gas on leaving the primary coolers passes to Bryan Donkin double inlet Rateau "Star" type turbo exhausters driven by 150 b.h.p. Brotherhood single-stage steam turbines. Each exhauster has a maximum capacity of 9.6. million cu.ft. of gas per day and is capable at maximum speed of producing 9 in. W.G. vacuum with a 72 in. W.G. delivery pressure.

Secondary coolers (by Whessoe, Ltd.) were installed to reduce the temperature of the gas leaving the turbo exhausters to within 2° C. of the inlet cooling water temperature.

Two tubular type detarrer units supplied by Whessoe, Ltd., each with a capacity of 4.8 million cu.ft. of gas per day and a total power consumption on full load of 3.5 kWh., are provided for the removal of final traces of tar fog in the gas leaving the secondary coolers.

The gas from the detarrers passes to the Whessoe ammonia washers which comprise three four-bay static type mild steel units with suitable by-pass connexions. The gas flow through the bays is alternately counter-current and parallel-current flow to the liquor circulation.

Benzole recovery is carried out in a static type Simon-Carves plant.



Ammonia washers with electrostatic detarrers. The secondary and primary coolers can be seen in the background.

DEVELOPMENT AT ST. ALBANS

The undertaking of the St. Albans Gas Company was founded in 1825. It progressed steadily, but slowly, until amalgamation with the Watford Company in 1929. In that year the St. Albans Works manufactured 310 million cu.ft. of gas. In 1947 the figure was 1,738 million cu.ft. This rapid growth is due to the absorption of the undertakings of Harpenden, Welwyn and Hatfield, Elstree, Hemel Hempstead, and Rickmansworth, and the greatly increased demands in those areas. In all, except Hemel Hempstead, the works have been demolished. They remain as holder stations and local centres for stores and district fitters. Since 1939 the Chesham Company have been supplied with all their requirements in bulk. A high pressure ring main from St. Albans supplies Welwyn, Hatfield, Harpenden, and Elstree. Rickmansworth is supplied from the Watford Station.

The three manufacturing stations with their 1947 production are as follows:

	Million cu.ft.
St. Albans	1,738
Watford	1,439
Hemel Hempstead	435
Total production	3,612

The area, which is about 251 square miles in extent, covers a large part of the county of Hertfordshire. It includes all the large towns of the county and most of its industry. It is exceptionally well served by road and rail communications. Three main line railways between the North and North-West and London converge in the area. These facilities undoubtedly account for the rapid increase in light industry which took place before and to some extent during the war. The districts supplied are sufficiently far from the Metropolis to be to a large extent self-contained.

Considerable development is taking place. Designation Orders have been issued for the new towns at Hemel Hempstead and Welwyn and Hatfield. The projected new town at Stevenage is partly within the area of supply. The London County Council is developing large estates at Oxhey and Borehamwood to house 50,000 persons. Altogether it is estimated that the present population will be doubled, bringing the total up to nearly 500,000. Local industries are to be developed concurrently, and the aim of the planners is that they shall be sufficiently varied to offer diversity of employment in the various neighbourhoods, and, where necessary, to balance what may at present be a lop-sided structure.

The limitations of the works sites at Watford and Hemel Hempstead preclude much expansion and it is the present intention to meet the rapidly expanding demand by further developments at the St. Albans Works. This site is the approximate geographical centre of the area and not only supplies the towns on the high pressure ring main, but the increasing demands in the Watford and Hemel Hempstead areas through a low pressure system. Plans have been drawn up to expand the St. Albans Works to a capacity of 26 million cu.ft. per day, and work which is already in hand or recently completed will bring the gas-making capacity to 14 million cu.ft. a day.

Carbonizing Plant

The carbonizing plant at St. Albans comprises three retort houses; a West vertical chamber installation of 3.5 million cu.ft. a day capacity, a West continuous vertical installation of 3 million cu.ft. a day, and a horizontal retort house of 1.5 million cu.ft. a day.

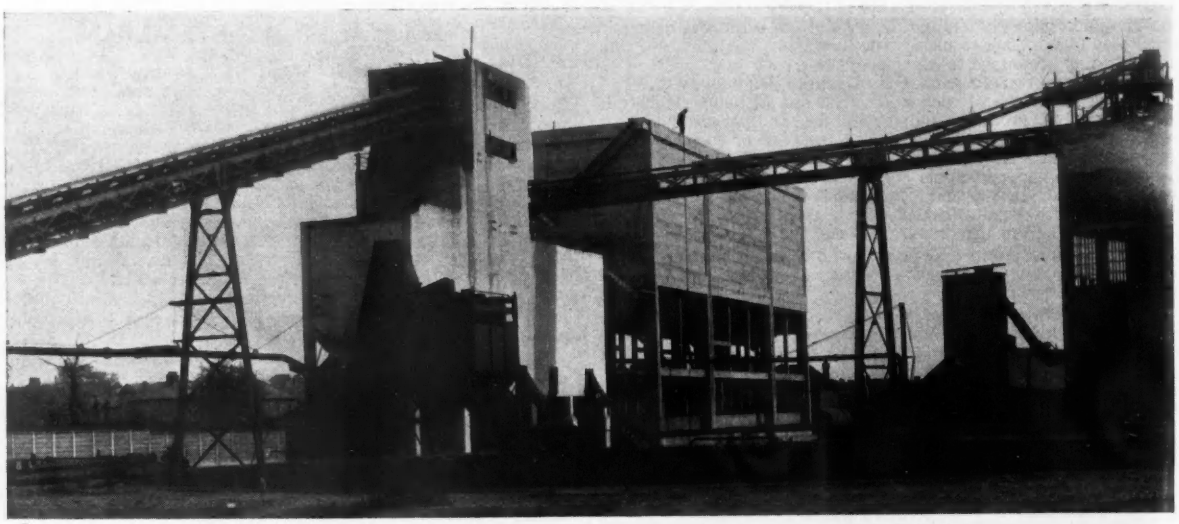
The West vertical chambers were installed in 1935 and worked continuously until February, 1948. This was the first installation of its type in the country and as a gas-making plant produced results of a very high order. The labour requirements of the plant, which is push-button controlled, are low; three men per shift operating a plant of 3.5 million a day. The charging operation is clean and there are no large volumes of coke to quench. A yield of 84 therms per ton was obtained at a calorific value of 540-550 B.Th.U. per cu.ft. It has been decided to rebuild in the same retort house a 4 million cu.ft. per day capacity continuous vertical installation.

The West's 3 million cu.ft. per day continuous vertical installation was brought into operation at the end of January, 1948. The new balanced heating has been incorporated and justifies the makers' claim of a low fuel consumption. The four producers built into the end of the bench are equipped with motor driven air blowers, which beside being silent in operation, allow better control of the steam/air mixture. The plant is at present producing gas of 510-515 B.Th.U. per cu.ft. A Drummond dust extraction plant has been installed and this has proved its value in providing greatly improved working conditions for the plant operators.

The reconstruction of the chamber installation to continuous vertical retorts is to start immediately.

Two Holmes Connersville and two Bryan Donkin rotary exhausters are provided for coal gas, which then passes through a Whessoe electro-detarrer and Holmes "Multifilm" ammonia washers.

Oxide purification is carried out in a series of ground level and over-



On Friday, June 11, some 300 members and ladies visited St. Albans and Whipsnade. In the morning the party had the choice of visiting either the St. Albans works of the Watford and St. Albans Gas Company, or St. Albans Abbey and the Verulamium. Both visits were well attended, and the parties later joined forces again and proceeded to Harpenden for lunch. A delightful afternoon was spent at Whipsnade Park Zoo, followed by tea and a most pleasant coach ride back to London.

head boxes. The overhead boxes, installed by C. & W. Walker, Ltd., are 30 ft. square by 10 ft. deep and have a nominal capacity of 3.6 million cu.ft. a day.

Carburetted Water Gas Plant

There are four sets of carburetted water gas plant, all by Humphreys and Glasgow, Ltd., having a combined capacity of 5 million cu.ft. per day. Three plants are hand operated, the fourth and last plant being a fully automatic self-clinkering unit. This last plant came into operation in September, 1945, and has been working continuously for long periods since that date. During the winter 1946-47 the plant was run for 10 months, in which time 766,000,000 cu.ft. of gas were produced without an involuntary shut down.

A second 3 million cu.ft. plant is in course of erection. Operation of the two plants will be synchronized.

Water Treatment

Water for works purposes is pumped from a well in the chalk. A large proportion of the water used for gas cooling is cooled over a natural draught cooling tower, and returned to the plant. For this purpose the hot water is collected in a steel hot well and pumped over the cooling tower. From the cold well the water is pumped back into circulation. For boiler feed purposes the well water is softened in conventional lime-soda plants, having a total capacity of 5,000 gall. per hour, followed by a carbonaceous zeolite unit, by Filtrators, Ltd., capable of treating 120,000 gall. between regenerations. Experience has shown that the works well water, treated in a lime-soda plant only is not entirely suitable for boilers having high rates of evaporation. Considerable trouble has been experienced with scale in both waste heat boilers of the gas tube type and boilers of the "Economic" type. In the carbonaceous zeolite unit the water is stabilized and softened to zero hardness by the "soap test." The alkalinity also is reduced and consequently the total dissolved solids are reduced to low concentrations of the order of 8 grains per gall. This process makes it possible to operate steam raising plant with the minimum of heat losses in the "blow-down" water. This plant is the second of its type to be installed, the first having been in operation at the Hemel Hempstead Works since the beginning of 1945, where, in a waste heat boiler, the proportion of "blow-down" has been about 2-2½%.

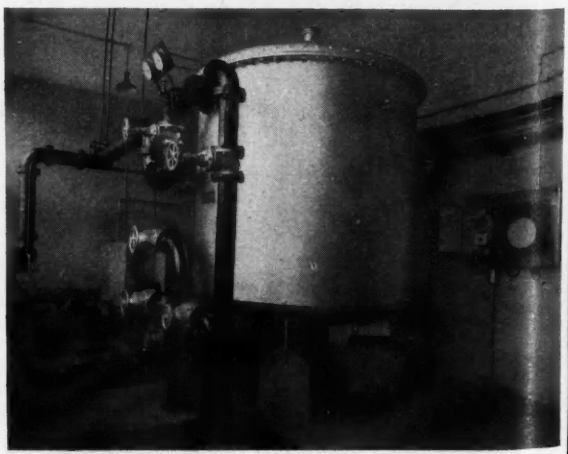
Gas Compressing Plant

Sixty-one per cent. of the gas now manufactured at this station is consumed outside the St. Albans area, and this percentage will be greatly increased. In 1947, 960 million cu.ft. were supplied from the high pressure ring main, and 111 millions through medium pressure trunk mains via the North Watford holder station. The compressors for the high pressure supply are two Bryan-Donkin reciprocating machines of 200,000 cu.ft. per hour capacity, against 25 lb./sq. in., coupled to compound steam engines of 290 h.p.

A large expansion scheme, ending in 1951, was approved by the Ministry of Fuel and Power two years ago, and estimated to cost £1,000,000. Of this sum £650,000 is to cover plant that has recently been completed, in course of erection, or on order, for the St. Albans Works.

A broad plan of development has been prepared which envisages a further extension of carbonizing plant by 12 million cu.ft. a day,

Operating Stage of the Carburetted Water Gas Plant at St. Albans.



The Water Softening Plant at St. Albans; Base Exchange and Stabilizing Unit.

bringing the total carbonizing capacity to 20.5 millions a day, and the addition of a third 3 million cu.ft. a day carburetted water gas plant.

It is proposed to install plant of the vertical type in units of 4 million cu.ft. per day built in line to facilitate coal and coke handling. Hot producer gas will be supplied from a battery of mechanical producers, after passing through cyclone dust extractors. Ash from the producers will be handled by a combination of a band conveyor and an automatic skip hoist, discharging into an overhead storage hopper. The problem of handling coke from the retort houses to the storage bunkers has not been solved satisfactorily.

A third fully automatic 3 million cu.ft. per day carburetted water gas plant is to be erected in line with the present plants. The operation of this set will be synchronized with the automatic plant now in operation and the set in course of construction. Normally two sets will be in operation during peak loads. The present intention is to add additional installations of overhead purifiers, each of 4 million cu.ft. capacity per day, although, having in mind new methods of purification, no decision has been made in this matter.

Sites have been selected for new benzole recovery plants. Provision has been made for the extension of the new concentrated liquor plant when this becomes necessary.

Consideration is being given to the development of a works on a new site, probably within the Welwyn-Hatfield area. Any scheme of this nature would, of course, limit the proposed development at St. Albans.

OTHER VISITS

The formation of the **Telegraph Construction and Maintenance Company** took place in 1864 as a result of a merger between Glass Elliott & Co. and the Gutta Percha Company, which had works at Wharf Road, London, N.1. The latter firm produced the insulated wires for the submarine cables manufactured and completed at the Greenwich Works. About 75% of the world's under-sea telegraph-telephone cables have been made and subsequently laid by the Telegraph Construction and Maintenance Company. It was not until 1933 that the plant and machinery from the Wharf Road Works were transferred to Greenwich and soon afterwards a new company, Submarine Cables, Ltd., was inaugurated, in which the submarine cable interests of Messrs. Siemens Brothers & Co., Ltd., were merged with those of the T.C. & M. Co., the new Company being held in joint ownership by the two firms.

While the production of submarine cables continues at a very high level the development and manufacture of new products at Telcon Works has progressively increased during the past 20 years, resulting in considerable extensions, both in buildings and plant, to the original factory at Greenwich. The 17½ acre site is now built upon almost to preclude any further major extensions at ground level. Present-day production now includes other types of cables, special metals, thermo-plastics, and engineering products, in respect of which a considerable business at home and overseas has been built up. Paper insulated power distribution cables and cables for high frequency operation are manufactured on a considerable scale, each requiring special machinery associated with their distinct types of insulating materials and finish. The use of gas as a heating medium is to be found at various stages of this cable manufacture. Furnaces for annealing copper wire, lead extrusion presses, armouring and serving machines are typical examples of equipment so concerned.

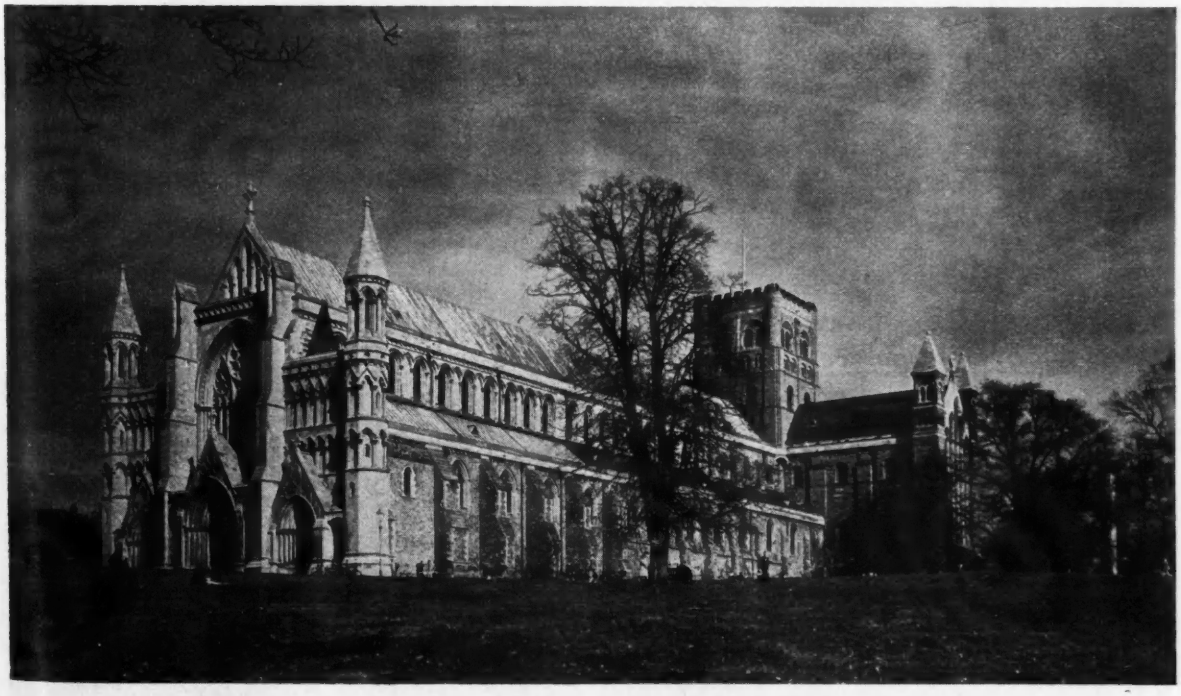
Of interest to the visitors on June 10 was the range of non-sparking tools made in beryllium copper produced in this section.

The visitors were cordially welcomed by Mr. W. F. Randle, Director of the Metals Division and a vote of thanks to him and to his Company was proposed by Mr. R. F. Twist (South Metropolitan).

The **British Oxygen Company's** Works at East Lane, Wembley, are devoted mainly to the production of oxygen in liquid and gaseous form which are produced by the process of liquefaction of air. Rare gases are also extracted from the atmosphere in the same plant used for producing the commercial oxygen of 99.5% purity used for welding, cutting, and numerous other industrial processes. Certain medical gases are also made, such as nitrous oxide and special qualities and mixtures of oxygen and carbon dioxide. Hydrogen is produced by the electrolysis of water, the resulting oxygen going to join the main bulk of supplies obtained from the atmosphere. The three main plants producing liquid oxygen are each driven by an 800 h.p. synchronous motor provided with power factor correction. The liquid oxygen is stored in insulated tanks from which it is drawn off into mobile insulated transporting tanks and delivered to the customers at points as far as 100 miles from the works.

The works of the British Oxygen Co., Ltd., were visited by large parties of members on June 9 and 10.

On June 10, a number of members visited the Charlton Works of **J. Stone & Co., Ltd.,** and inspected the casting of various non-ferrous metals and of ships propellors.



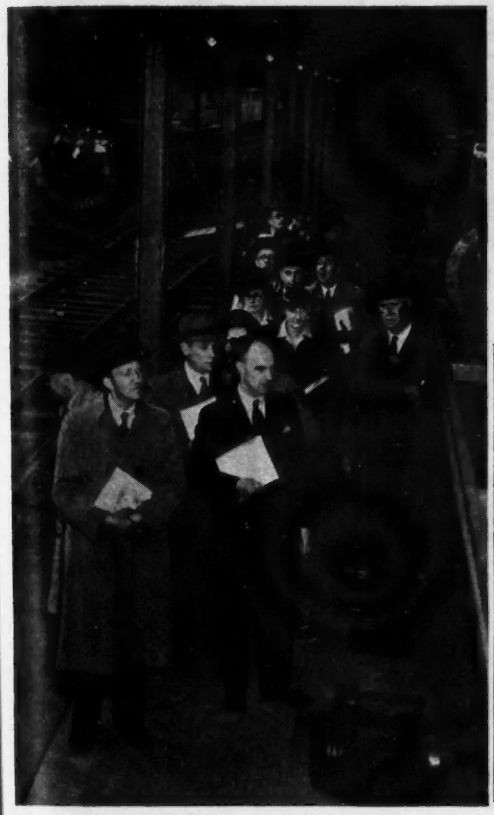
Visitors to St. Albans last week will have been reminded of the history of this old city, built around the ancient pre-Roman settlement of Verulamium. The history of the city would be, in miniature, the history of England. Here the ancient Britons fought the Roman invader; the townsfolk besieged the Benedictine Abbey during Wat Tyler's rebellion; and twice during the Wars of the Roses the Yorkists and Lancastrians met in battle outside the town. This month the three churches of St. Michael, St. Stephen, and St. Mary celebrate their millennium. St. Albans is described in the guide books as "finely situated on an eminence above the River Ver." This is a fair description. Approached from the south, the scene is dominated by the Abbey with its fine square Norman tower, keeping watch on the city and presenting, as it were, an injunction to all concerned to maintain the dignity of the surroundings. The land for many miles around was, until the dissolution, in the ownership of the Benedictine Abbey, and perhaps it is not unfitting that the city should again become a centre of power, exercising its influence on the surrounding areas.

PICTURES FROM ST. ALBANS

Our photographer supplies a pictorial record of the Institution's visit to St. Albans Abbey and the works of the Watford and St. Albans Gas Company

GUESTS OF THE GAS LIGHT AND COKE COMPANY

A Selection of photographs taken during the successful visit to Beckton on June 9



THE S.B.G.I GOLF CIRCLE MEETING

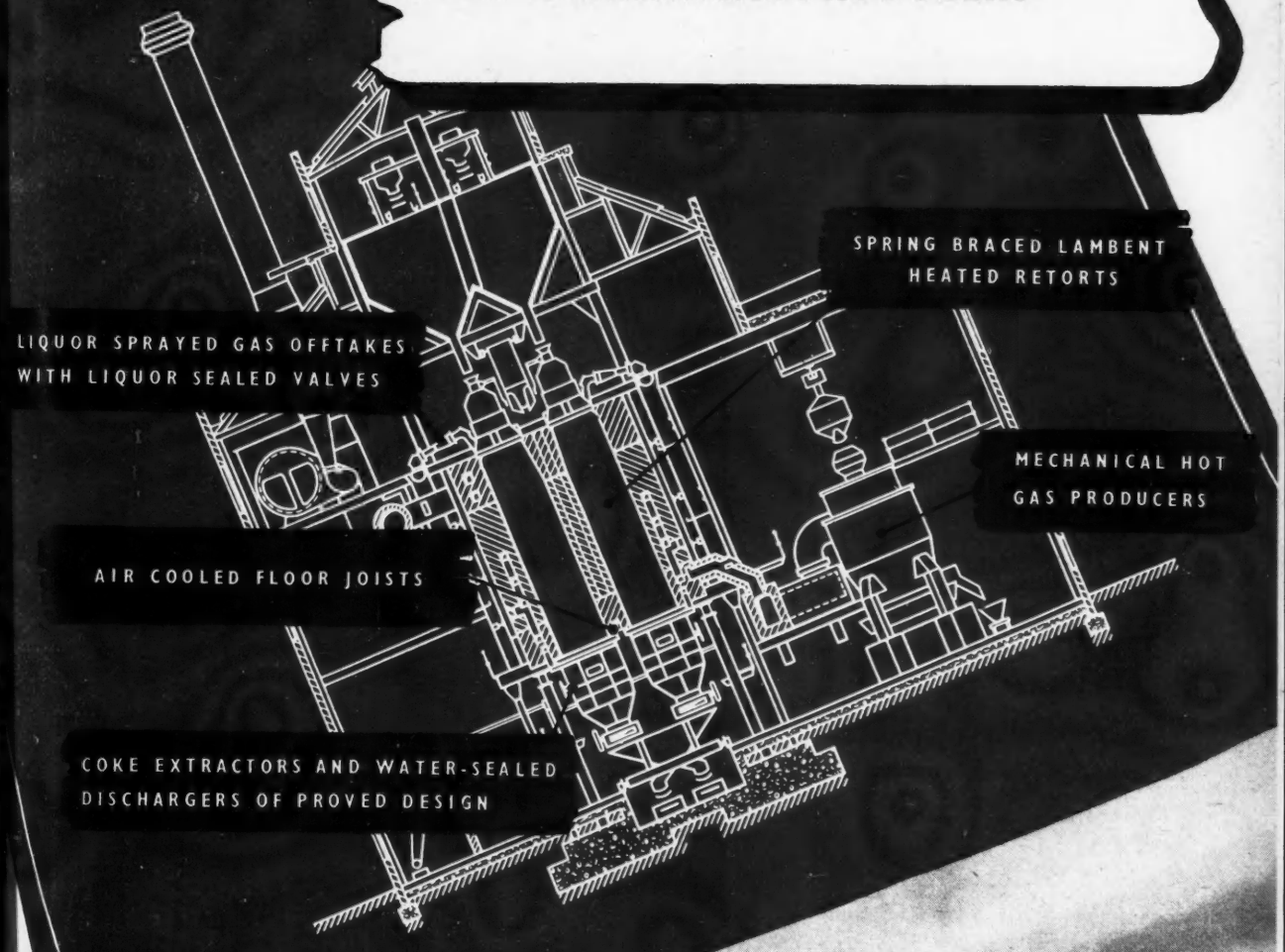
Above: Messrs. J. Hunter Rioch, C. A. Macleod, W. R. Edgar, and the Hon. Secretary, Mr. W. Morland Fox.
Right: Messrs. S. H. Stokes, B. Pollard, H. F. Potter, L. H. Pickles, T. C. Battersby, C. A. Macleod, M. W. Burt, J. S. Smith, F. D. Drake, J. Hunter Rioch, J. Simpson.

The group of sportsmen at the left comprises: Messrs. F. D. Drake, H. R. Hiscott, S. C. Thomson, Dr. J. G. King, H. E. Bennett, H. Bardgett, C. H. Pearson, R. D. Dimond, N. Smith, N. Johnson.

THE ROYAL BOTANIC GARDENS, KEW

Left: Mrs. J. G. Aitken, Mrs. J. P. McCrae, Mrs. S. J. Beale, Mrs. Cecil Poulson and Mrs. Clifford King. Thanks were due to, among others, Miss Cato and Mr. King, of the I.G.E. Staff, pictured above.

A MODERN RETORT HOUSE —
W-D CONTINUOUS VERTICAL RETORTS WITH MECHANICAL PRODUCERS


SPRING BRACED LAMBENT HEATED RETORTS
LIQUOR SPRAYED GAS OFFTAKES WITH LIQUOR SEALED VALVES
MECHANICAL HOT GAS PRODUCERS
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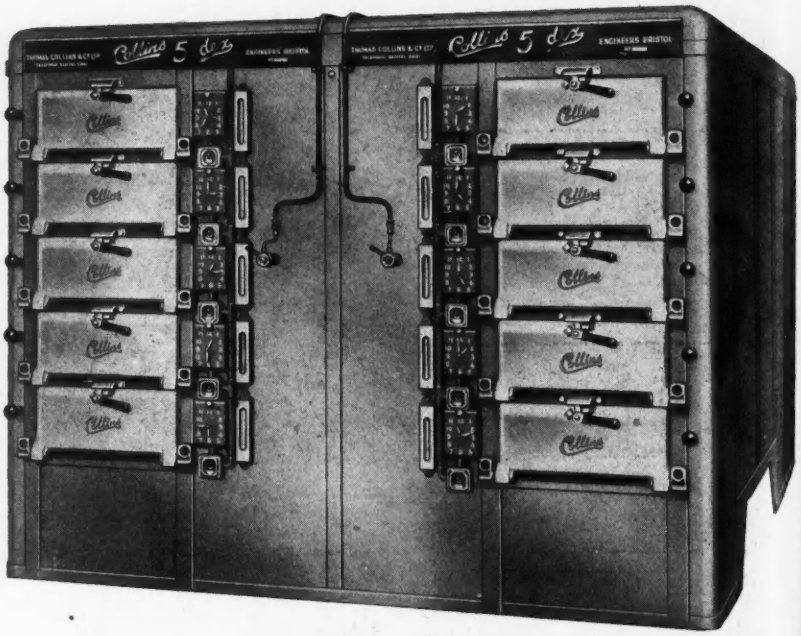

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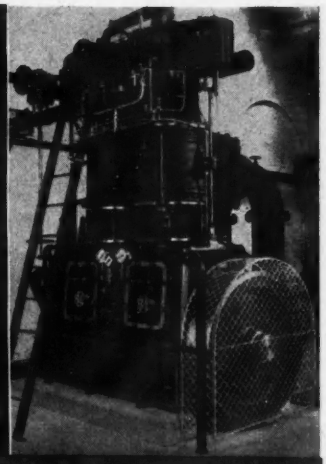
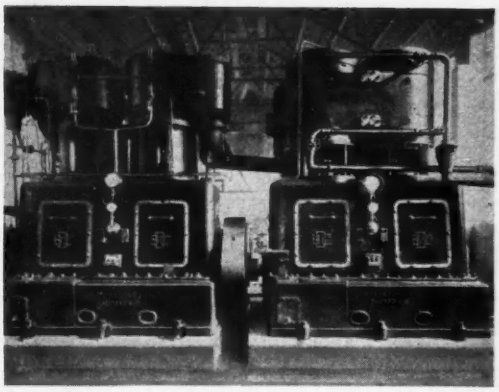
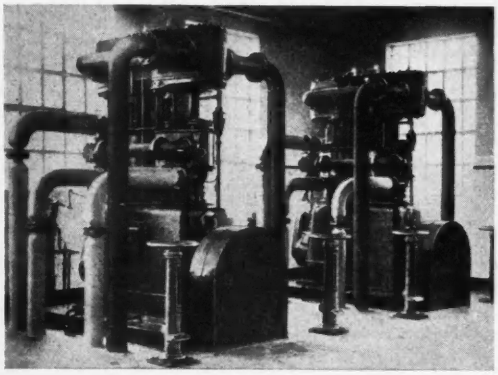
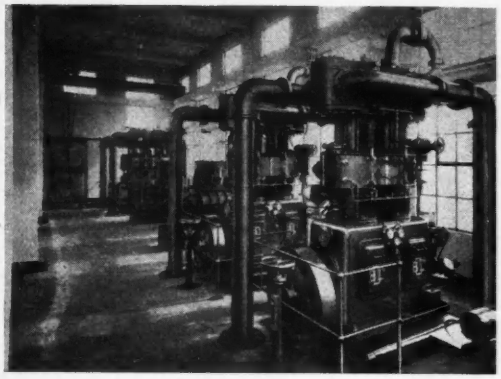


Gas COMPRESSORS

HIGH SPEED
VERTICAL
RECIPROCATING
TYPE
FOR PRESSURES
UP TO 100 LBS./□"







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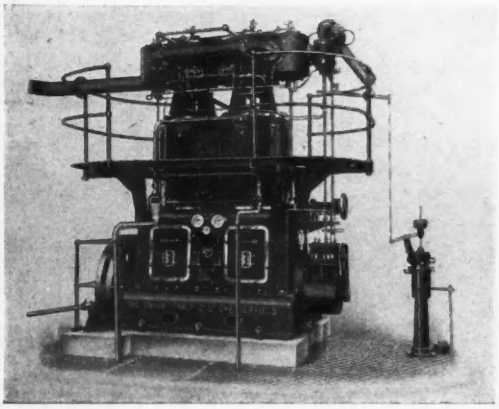
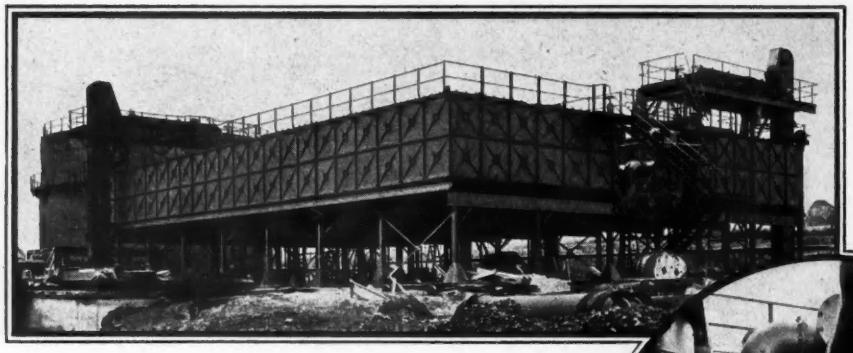
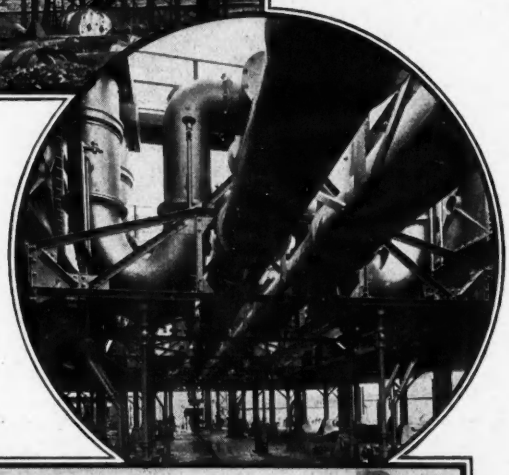


ELEVATED DEEP PURIFIERS

by Dempster OF ELLAND



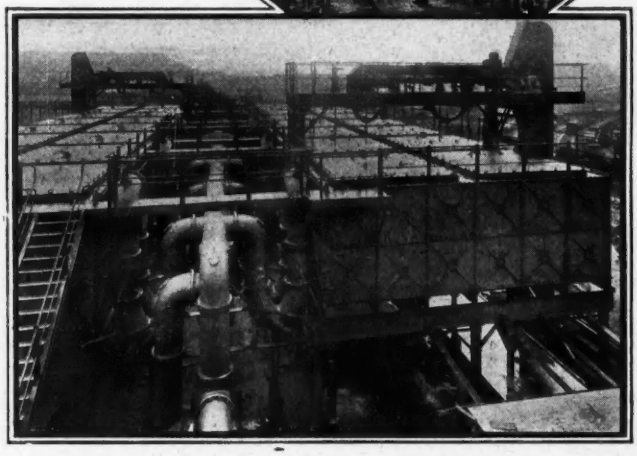


As specialists in Purifier design, we have given considerable attention to this type of installation, and have built many such sets.

We illustrate a contract comprising 8 Boxes, 30′0″ × 30′0″ × 10′0″ deep on Steel Structure, with our Combined Travelling Oxide Plant and Cover Lifting Gear.

Top: General view. (In background, Gasholder also erected by us.)
Inset: Showing Connections.
Bottom: Overhead view.

These Purifiers designed for a gross capacity of 8,000,000 cu. ft. of gas per day.



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INSTITUTION VISITORS AT THE ASCOT WORKS

Lord Limerick, with the President, announcing the presentation of the one millionth Ascot water heater.

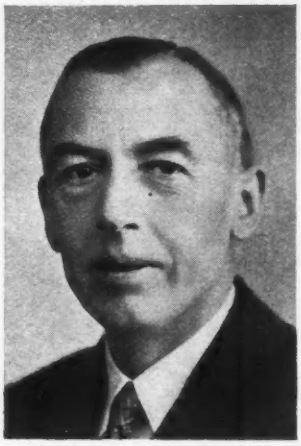
ON Wednesday, June 9, a large party of Institution members and ladies visited the Neasden Works of Ascot Gas Water Heaters, Ltd. A most interesting time was spent seeing the various stages of water heater manufacture, and visitors were left in no doubt as to the research and careful workmanship which are embodied in every Ascot appliance. They were particularly struck with the way in which all work is co-ordinated so that the minimum of effort is required by the operatives, and with the high importance attached by the Company to the application of precision testing as a means of ensuring high quality appliances.

In the canteen all the services of the Company were attractively displayed: The service section covering the renovation and repair of heaters; educational film strips and technical literature; sectional models for use with town gas and Calor gas; the special products section showing the development on various accessories, and a hot water control unit for particular use in bakeries or any factory requiring a large quantity of water at a given uniform temperature; and, finally, the special tools section, which included the Ascot burner piercing tool.

During tea and refreshments supplied by the Company, the Chairman, the Earl of Limerick, K.C.B., D.S.O., in welcoming the visitors, referred to the fact that this was the 21st birthday of the Ascot Company and that it was most appropriate the Institution should have chosen to visit the works this year. Dr. Harold Hartley, President of the Institution, in thanking the Ascot Company for their kindness and hospitality, stated how pleased he was to carry out the "domestic" ceremony, suggested by the Earl of Limerick, that he should present to the Company's oldest employee, Mr. F. Noot, the millionth Ascot heater. This heater, the RS52/1 Ascot boiling water appliance, carried the signatures of the Board and all Executive Officers of the Company.

This cheerful group of Institution members and their ladies represents a third of the total number who visited the works of Ascot Gas Water Heaters, Ltd. The President is seated in the centre, with Lord Limerick on his right and Mr. F. P. S. Stammers, Executive Director of the Company, on his left.

NEW I.G.E. PRESIDENT AND VICE-PRESIDENTS



E. CROWTHER, President of the Institution, 1948-49.

C. H. CHESTER, O.B.E., Senior Vice-President.

F. M. BIRKS, C.B.E., Junior Vice-President.

THE 1947 INSTITUTION MEDALLISTS

One of the most outstanding contributions towards the improved use of electricity on a gas-works was the paper by Mr. **G. M. Rimmer,** A.M.I.E.E., M.AmericanI.E.E.,entitled "Electricity in the Gas Industry." Read at the 84th annual general meeting of the Institution of Gas Engineers last June, this paper was selected for the Institution Gold Medal, 1947. Mr. Rimmer, who is Electrical Engineer to the Birmingham Gas Department, showed that great progress could be made in mechanization of the industry if the problems were really understood and if electric plant could be considered as reliable as steam. The paper dealt with the sources of electric supply and particularly the generation of electric power on gas-works, the distribution of current, and electrical control and instrumentation. By no means least was the valuable section dealing with electrolytic corrosion and the prevention and detection of current leakage.

G. M. RIMMER

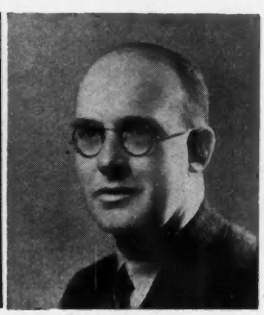
M. NOONE

The H. E. Jones London Medal, 1947, was awarded to two officials of Whessoe, Ltd., Mr. **M. Noone,** who is Chief Engineer, and Mr. **A. G. Grant,** M.Sc., Director and General Manager. Their joint paper, "The High-Pressure Gasholder," was read at the 84th annual general meeting of the Institution of Gas Engineers in Birmingham last year. The paper, which set out to define, develop, and, if necessary, to defend the high pressure holder, maintained that the choice of construction should lie between riveting and X-ray proved welding. The question of riveting or welding received considerable attention, it being stated that while a properly designed, constructed, and tested riveted holder was wholly satisfactory, power riveting could not entirely replace hand riveting, and the general trend was, as in steam boiler practice, towards welded construction.

A. G. GRANT

The winner of the Institution Silver Medal, 1947, was Mr. **A. K. Collinge**; his paper, "Four Years' Development at Preston," was presented at the Autumn Meeting of the Manchester District Association in October. The paper dealt with the Lostock Hall Gas-Works of the Preston Gas Company, of which he is Engineer, and described its development to meet an increasing demand.

A. K. COLLINGE



J. A. SPEERS

Mr. **J. A. Speers,** M.Sc., who was awarded the Institution Bronze Medal, 1947, for his paper on "The Influence of Packing Density in Purifiers on Resistance to Gas Flow", read at the half-yearly meeting of the North of England Gas Managers' Association (Auxiliary Section), also holds the Institution Diploma and, in 1936, was awarded the S.B.G.I. Silver Medal.

DR. H. HARTLEY'S PRESIDENTIAL ADDRESS*

THIS year marks the approaching end of an epoch in the history of the gas industry and of this Institution. In it there have happened two events, each of which will have a marked influence on our activities as a corporate body and as private individuals. Firstly, the Government is taking steps in the present session of Parliament to integrate the gas undertakings on a regional basis. Secondly, the Council of the Institution is appealing for financial help to enable a fund to be collected for the purchase of headquarters.

Evolutionary Growth of the Gas Industry

Both these events fit logically into the development of the gas industry, which has a record of evolutionary progress resulting in a remarkable growth in stature. It was well established at the time of the birth of this Institution in 1863, and the subsequent phases were periods of expansion associated with notable technical progress. Competition from the electrical industry, which at first seemed capable of threatening its very existence, had the effect of stimulating progress in a remarkable manner. The search for new fields of application has been much helped since the first world war by an appreciation that full development depends mainly on three things—firstly, the capacity of the undertakings to operate economically in an important heat supply industry, secondly, on their ability to play a part in the growth of the chemical industry, and thirdly, on a full appreciation of the duties involved in performing a social service for the community as a whole.

The story of the growth of the industry provides evidence of both the advantages and disadvantages of competition as a means of ensuring progress and efficient operation in various spheres of activity. The fact, however, that there were so many independent and autonomous gas undertakings often delayed unnecessarily the general application of changes which were felt by many to be desirable. For many years now there has been recognition of the need for alteration in the organization of the industry. This first bore fruit in the form of expansion of both privately and municipally owned undertakings by the process of absorption of adjacent concerns with which a physical link could be effected. In the years before the second world war, and during the war, the movement in favour of integration gained more and more adherents within the industry, and the Report of the Post-war Planning Committee of the British Gas Federation, published in 1943, proposed geographical integration of undertakings. This concept was subsequently endorsed by the Heyworth Committee. The Government has decided the desired end shall be attained by nationalization, and the necessary legislation is now in the process of enactment.

The Institution and its Headquarters

Earlier this year the Council decided that steps must be taken to secure funds to enable the Institution to acquire its own headquarters. The Institution is, and must remain, an autonomous body, and at all times guard jealously the professional freedom and status of its members and ensure the maintenance of its functions.

During my year of office, there has been nothing more heartening than the permission granted by the Minister of Fuel to the undertakings about to be nationalized to subscribe to the Headquarters Fund. On behalf of the members of the Institution, I wish to thank both the Minister and the members of his Department who have been so helpful. It was stipulated that the arrangements for acquiring and dealing with the fund must be acceptable to the Ministry of Fuel, and that evidence be provided that the members themselves really feel the need for the Institution and would subscribe liberally. Some 60 members were approached privately, and the generous offers of help received are greatly to their credit. Many of the gifts are to be made under covenant, and in total these donations should yield about £4,000 to the Institution. It is expected to raise £10,000 from members, and I am confident that all will give the maximum their means allow. I hope donations will be made where possible by payments under covenant. Even a guinea a year for seven years is a great help. Some of the leading gas undertakings and member firms of the Society of British Gas Industries were also approached. In all promises of gifts totalling £60,000 were received before the public appeal was launched. The ultimate target is £100,000.

For the last 11 years the Institution has had its headquarters in No. 1, Grosvenor Place, as sub-tenants of the Gas Light and Coke Company. In view of the change contemplated this is a fitting occasion to acknowledge the generous help the Institution has received whenever needed from that famous undertaking—the largest Gas Company in the world—so soon to lose its individuality.

Functions of the Institution

From the time of its foundation, this Institution has played a great and an honourable part in the growth of the gas industry and from it have been developed many of the national bodies for the extension of functions previously performed by the Institution. The subsequent concentration of its work has permitted more effective handling of its activities. The functions of the Institution are now three-fold: professional, educational, and technical.

Through its Education Committee and its Technical Committees, it deals with matters which are not normally peculiar to any particular locality, but are nation-wide in character. It is the recognized liaison in such matters between Government Departments, other national authorities and kindred Institutions, on the one hand, and gas undertakings and gas engineers on the other.

In the Gas Bill now before Parliament, a specific duty is laid on the Gas Council and the Area Boards to ensure that certain activities ancillary to the manufacture and supply of gas and coke shall be developed. Some of these relate to work in which the Institution has much experience and in which it desires to participate. It is hoped that, when the industry is nationalized, financial grants such as have been made in the past by the gas undertakings will be continued by the competent authorities, and that they will regard the Institution as an "appropriate organization" for the purpose of such functions.

The Minister of Fuel intends to retain the authority himself to deal with matters relating to the nature and the quality of gas supply, to its metering and to safety regulations. The corporate experience of the Institution in all these matters is exceptional and it would welcome the opportunity of placing this knowledge at his disposal.

*Communication No. 332 of the Institution of Gas Engineers, presented in London on June 8, 1948.

Membership of the Institution

It is now some 12 years since the Council took action to amend the conditions for membership so as to allow men trained originally as chemists or physicists, who had been enlisted for the expansion of the gas industry, to become full members of the Institution. Thus there were admitted a number of other specialists, not only from the staffs of gas-making organizations, but also from the staffs of the member firms of the Society of British Gas Industries. In due course the experience of such members had its influence on the deliberations of the Council, and some have been awarded the highest honours this Institution has to offer.

The trained engineer is rightly jealous of the standing of his professional Institution, and none more so than the gas engineer. The decision to modify the professional requirements for admission to this Institution was a recognition by men of full professional stature of the growing need for help from the other sciences. These have a major part to play in finding solutions to some of the many problems still to be solved in the expansion of the gas industry. As time goes on, the need for more men trained primarily as chemists, physicists, mathematicians, metallurgists, and the like will increase. Such men will be required not merely for routine process control, or even for background or applied technical research, but to aid in the extension of other activities with which the industry is concerned, as well as for that general superintendence which until quite recently has been the province of men trained primarily as engineers. It is important then that the Council shall take such steps as may be required from time to time to keep abreast of the technical developments of the industry. By ever strengthening its professional membership, both the industry and the Institution will benefit, and the latter should so grow in stature that ultimately it will be regarded as a *sine qua non* by anyone occupying a high technical position that he shall be a member of this Chartered Institution.

It must always be remembered, however, that men do not unite in professional institutions for mundane matters only, but to retain freedom for creative thought and full development of the mind.

Need for Expansion of the Spheres of Research

The planning and execution of research for the industry as a whole was done formerly only by this Institution, and some nine years ago, in conjunction with the Society of British Gas Industries, it took steps which led to the formation of the Gas Research Board —an autonomous body. To-day, these three organizations collaborate closely in such matters, and it is a personal hope—no doubt shared by many others—that there will be no change in the future which will interfere with this co-operation in a field of activity in which sectional interests are least likely to come into conflict.

The rise of the gas industry has been roughly coincident with, and one of the fruits of, the use of science in industry. Although both the range and the intensity of application of scientific methods have steadily increased, it is nevertheless true, as a generalization, that scientists have been largely preoccupied with the physical and chemical processes underlying industry, and hardly at all with its ultimate objectives in the broad sense. The expression "applied science" suggests, for example, the application of combustion research to appliance design, but not the need to study the habits and the preferences of gas users; yet the study of the problems of that field would benefit by the application of the scientific method. The progress of the industry will depend not only on the excellence of its technical processes, to which considerable thought is given, but also on a detached and factual study of the objectives and the fields of application.

Examination of Functional Value

About half a century has elapsed since production specialists first paid attention to motion study, to improvement in shop lay-out, and so on, as a means of increasing production. Striking increases in output have been secured in all kinds of manufacture by suitable analysis of the processes involved and the results attained. Similar analysis of the uses of gas and coke appliances should reveal their true functional value and aid their rational development, as well as provide data for assessing the potential demand. The application of the scientific approach to the examination of such matters—*i.e.*, functional research—will benefit from the experience gained in the wartime use of the methods of so-called operational research. It is the subject matter, and especially the methods of dealing with the problems and analysing the results which may seem new to many. The underlying principle is to collate the results attained after control of the different variables, and assess their significance by the use of the tools of the statistician. The mode of approach varies, and the suggestion has been made that the ideas underlying some of the laws of natural science should be applied to the spheres of economics and human reactions.

Departure from the range of phenomena which can be studied conveniently in the laboratory, or otherwise under full control, makes it the more necessary to use statistical methods to disentangle the variables and to assess the significance of the observations made. This latter process is essential in any attempt to interpret and systematize the data so as to provide a basis for future action.

The application of operational or functional research should be especially helpful after the industry is integrated, when the magnitude of the effects of any major decision by an executive authority may be correspondingly increased. The need for a firm foundation for such decisions is manifest.

Warmth and Comfort

The use of gas for the production of heat in the domestic sphere has been developed to such a state that, in the further improvement of many appliances, gains in thermal efficiency will play a less important part in enabling the field of application to be expanded. For the future, more consideration will need to be given to factors such as functional values which are important in determining the service which the user obtains.

Those with experience in investigating space heating problems from the comfort aspect know how misleading individual experience may be as a basis for general decision. The work of Bedford, for example, shows the wide diversity of opinion that exists as to what constitutes comfortable warmth. With room temperatures judged by the majority of people to be quite comfortable, some complained they were too cold, while others felt too warm. Such experience supports the view that faulty decisions often arise from over-emphasis of chance happenings.

Investigations of the operational research type lead to an appreciation of the conditions which are likely to be most generally acceptable or effective, and can show what percentage of subjects would be included within any given range of results. Furthermore, on the basis of a given number of observations, the degree of certainty attainable can be specified numerically. Naturally, the greater the importance of any decision to be based on the data, the higher must be the probability factor, and the scale of investigation must be settled accordingly. To increase the certainty of a result from x to $(x + a)\%$ might, however, involve a wholly disproportionate and perhaps impracticable increase in the data to be collected and analyzed. As in most other fields of human activity, it is desirable to cut one's coat according to one's cloth, and before embarking upon such work it is necessary to decide on the degree of accuracy to be attained, so as to secure the maximum economy of effort.

Cooking

In the past, decisions as to desirable features of heating and cooking appliances have been taken at times on the basis of seemingly well-informed opinion, rather than on facts established on a firm statistical basis, and it is often difficult to assess the true value of such information. It has happened that advice from different sources, presumably equally reliable, was contradictory, and in past surveys of consumer preference on cooker design it has been found that some of the recommendations for improvement cancel each other. To take a small example, there is the recurrent request for "simmering" burners to be put at the rear of the hotplate. On the other hand, there are operational reasons for placing the simmering burner in the front, and while the alternative position is practicable, some small complication in design and increase in cost are involved, especially with the duplex type of burner. It would be helpful to know, on a statistical basis, how general such a need is among housewives. At present there is no means of knowing what such an alteration would be worth.

In a Communication to this Institution six years ago, reference was made to data collected from 10 pairs of houses in a well-known Children's Home. Each house had approximately the same number of inmates and the diets were the same. The records for two successive years for the individual house consumptions showed a scatter between 294 and 408 therms per annum, although the arithmetical averages of the consumptions in all 20 houses for each year were 354 and 357 therms, respectively. The ovens were thermostatically controlled; did the variations arise mainly from the manner of using the hotplate, on which over two-thirds of the gas may have been burned? Were the burner adjustments at fault or the basic ratings too high, so that close attention was needed to avoid serious waste? Can the majority of users in fact really afford the luxury

of high-powered apparatus? Ought ingenuity to be applied to the provision of more appliances with means for controlling consumptions automatically in relation to the work to be done? Such questions can only be answered satisfactorily by examining data resulting from mass observation.

Considering the cooker more generally, the British product is sometimes compared unfavourably with that of other countries, because the latter are provided with more accessories which the housewives concerned have been persuaded are advantageous. How far are such devices really needed by the user and how many of these are used or usable when the cooker is 12 months old? The relative absence of such accessories on appliances made in this country is not due to the lack of technical ingenuity. The most difficult part of appliance design often lies not in the technical achievement of a result, but in deciding whether the need for a given improvement justifies the complication and additional cost involved. Any means of eliminating or minimizing the guesswork involved in such decisions is obviously of importance.

Gas Making and Marketing

The application of the methods of operational research to gas manufacture and distribution might be advantageous. The influence of space heating on the demand for gas, for example, to which reference was made by Mr. F. M. Birks, C.B.E., in his Presidential Address to the Fuel Luncheon Club, is suggestive. Later during this 85th Annual General Meeting, there is to be presented for discussion a paper by Mr. S. Everard, M.B.E., which is concerned with a similar approach to allied problems of an undertaking. Comprehensive as these particular investigations have been, it will be agreed that as yet the subject has only been dealt with superficially by the gas industry generally. In the particular field of market research, much has been done in the United States of America, but, unlike process research, the results may not be applicable over here. The study of such work does, however, illustrate the need for a wide survey if the results are to be of real value.

It would be useful to apply operational research methods to the activities of the gas undertakings' maintenance staffs. Although the task of the maintenance engineer is being lightened by the use of improved appliances—by the introduction of corrosion-resisting materials and such accessories as scale reducers for water heaters, by the provision of self-clearing teats or "neat-gas" burners in gas fires, and by the elimination of fragile radiants—nevertheless the higher standards of performance now expected from all domestic appliances may necessitate attention to apparatus of the type which in the past has not been serviced. By suitable investigation, also, a quantitative appreciation of the advantages of reduction in the sulphur content of gas might be obtained.

Many gas undertakings have kept records of the condition of certain appliances, and have studied their behaviour over a considerable period. I am not aware, however, that in analyzing the information gained the type of examination has been applied which has yielded such striking results in other fields. It is difficult for any but the largest undertakings to acquire the necessary specialized technique, and the larger groupings now envisaged will be better able to undertake this type of work. There is, no doubt, a large amount of potentially useful information in existence from which by further analysis useful conclusions might be extracted.

The application of operational research methods is being made to the analysis of the causes of variability of strength in small refractory parts, and the results which are being attained promise to enable works control to be improved at the crucial points, so as to lead to the production of a more uniform and basically stronger unit. Consideration is also being given to the use of this type of study in the enamelling of the multiplicity of parts which pass through the factories of appliance makers, although the number of variables is so great that the collation of the large mass of statistics necessary may not be justifiable. It may be desirable to effect further improvement by the empirical application of known controls, and defer the more scientific analysis to a later date, when, with fewer variables, effort can be concentrated on those most likely to influence the final result.

Some Future Loads

The industry looks forward with confidence to a considerable extension of the sphere of application of its products in the future. Much could be done at once were there not such limitations on the supplies of labour and materials. The enforced marking of time will, however, provide opportunity for consideration of the loads which should be sought, as distinct from work which could be tackled but might be done more satisfactorily by other means. This will in general be determined by the service which can be provided, by the cost which will be involved, and by the advantage which the consumer will obtain.

The desirable applications of gas and coke are numerous, but brief reference to some matters in the domestic sphere may be of interest.

Cooking provides the basic domestic load for gas, and accounts for about 50% of the total used in this country. Progress in the technical design of apparatus results in less gas being needed for cooking a meal, and yet it is not likely the industry will obtain a bigger proportion of the domestic cooking load than it holds to-day. Improvements in the general standard of living may increase the amount of gas supplied by an undertaking for this purpose, but on the whole it would seem more likely that, with the passage of time, the gross cooking consumption will tend to decrease.

The field for water heating offers great possibilities for increased consumption of both gas and coke. This is already being developed, and when conditions become normal endeavour will be made to effect considerable expansion. This load can, if so desired, be made a steady one for gas, and, by the use of suitable types of heater, even daily peaks can be eliminated. Individual experience suggests that in such cases in any one household, although there is some seasonal change, the weekly consumptions vary chiefly with alterations in the number of the household. It many areas the average population is stationary over a large part of the year, so that if the experience is general water heating may become much more valuable as a basic load than the present cooking load.

A third sphere is house warming, which calls for the largest provision of heat. For whole-house heating, depending on the standard desired, up to 500 useful therms may be absorbed per annum, even for a house of 950 sq. ft. superficial area of the type now being erected; this is equivalent to the use of 700 therms of potential energy at an efficiency of 70%.

A full domestic service might involve the supply annually of roughly 900 useful therms, and this can be provided either by using solid fuel, or gas, or electricity.

Despite the fact that house warming can be done effectively with either gas or coke, much of this load may be retained by the coal industry. As a result of recent developments it is possible to burn bituminous coal in a suitable whole-house heating furnace at an overall efficiency of the order of 70%; the emission of smoke is negligible, while the stoking and the removal of ashes are done once daily.

Whichever fuel is used in such furnaces the heat produced can be applied in a number of ways for warming the house and providing a bulk supply of hot water. For house warming the energy generated in the furnace can be transmitted to air which is circulated throughout the building. This may be done either by passing it directly through the rooms or through a series of ducts under the floors in the house; also the systems can be combined or applied in other ways. The supply of heat to any one room can be varied at will and with the whole system under thermostatic control the minimum of attention is needed from the householder.

Trials in Progress

The erection in the London area is now almost completed of two houses which have been designed as extra-mural laboratories for the application of alternative systems of whole-house heating. In one of the houses a gas-operated unit is installed, and in the other a solid-fuel furnace. Arrangements have been made also for equipping a number of houses in the provinces. In these cases the systems are being applied to buildings in the course of erection by local authorities, and negligible modifications of the structures are involved. Tests were started in the first pair in April.

The extent to which such systems of heating are used in the future will depend not only on the cost of installation and operation, but also on the reactions of people to convection heating, and it may be that in this country there will be a demand for a certain amount of high-temperature radiant energy for many years to come. Reference is made to this matter here in order to bring it to the more general notice of the industry. Consideration will, no doubt, be given the desirability of offering coke and/or gas for such work.

The potential demand is great, and if it is to be absorbed on a large scale with gas the industry will have to analyze the problems that will arise in the making of gas, its purification, and its distribution. It would seem that

(1) with the present system of gas-making a heavy load of this type would give rise to a serious problem in connexion with coke disposal, while the gasification of largely increased amounts of coke by present methods would increase the cost of gas-making quite appreciably;

(2) the influence of changes, if any, in the purification costs would probably be small;
(3) the savings to be effected in distribution costs with such a largely increased domestic demand for gas might more than compensate for the increase in manufacturing costs, even allowing for the gasification of a much increased amount of coke.

Neglecting supplies from coke ovens, it would seem that the provision of cheap gas for large-scale whole-house heating would depend chiefly on the disposal of the coke. Further consideration appears to be needed of the possibilities of more complete gasification, and of designing plant which, while operating at a high efficiency, will be highly elastic and will, if possible, allow of reduction of capital charges. So much interest is being evinced in Government quarters in the question of whole-house heating that it is desirable the gas industry makes up its mind what it can and will do in regard to the matter. So far as supplies of coke and gas are available, a portion of the load should be obtainable.

It might be thought that if the gas industry cannot deal with the whole-house heating load by the supply of gaseous fuel, it would be quite out of the question for the electrical industry to supply the energy required. If there were no method of providing the necessary warmth other than by degrading electrical energy directly into heat, as is the common practice to-day, this would be so. It must be remembered, however, that by the use of the heat-pump it is possible to upgrade the low potential heat available in the earth, and, by so attaining a high coefficient of performance, reduce the load which must be drawn from the supply undertaking's mains. It seems as though it will be practicable in a self-contained system suitable for the average size of house (although at what prime cost is not yet known) to supply 4 B.Th.U. for house heating for the equivalent of every B.Th.U. purchased from an electrical supply undertaking.

It is hoped that this fact will stimulate more thought in the gas industry about the possibility of effecting radical changes in the methods of utilizing the potential energy available in its fuels.

Conclusion

This address deals for the most part with material considerations which will have an influence on future events. To-day, men's minds are much concerned with "planning"—no doubt because of the relative ineffectiveness of some of the methods of the past. The best results of "planning" have occurred when bureaucratic control has been avoided and the individual has been called upon to play a part and influence his own future.

It was Jefferson's idea that the best Government is that which governs least, and this applies to industries and to businesses. Good administration succeeds by devolution, by the placing of the maximum of authority and responsibility with the individual, who in general then gives of his best and develops the more, the more there is expected of him. In the past we have been aware of the existence of but few great or inventive minds, though there must have been many men of high calibre who were never used.

The future is with the younger men, and we who have greying hairs should, like Agag, tread delicately.

You did me great honour a year ago by appointing me President of this Institution. I approach the end of my year of office with a feeling of regret; the work has been strenuous, but it has been enjoyable. I have learned to know the gas engineer better than ever before. I have had an opportunity of appreciating as never before his worth as a man and as a technician, and of learning something of his respect and love for this Institution. I have formed many friends, and feel that I have been blest beyond my deserts.

RELATIONS BETWEEN MINISTRY AND INSTITUTION

MR. GAITSKELL'S CONFIDENCE IN NEW SET-UP

THE President's Luncheon was held at the Savoy Hotel on June 8, the principal guest being the Right Hon. H. T. N. Gaitskell, C.B.E., M.P., Minister of Fuel and Power.

Dr. **Hartley,** proposing the toast of "The Guests," extended a cordial welcome to the overseas visitors, Presidents and representatives of kindred organizations, the Chairman-Designate and Deputy-Chairman-Designate of the Gas Council, Sir Henry Tizard, President of the British Association for the Advancement of Science, and, of course, Mr. Gaitskell. The Minister's work in determining the framework within which the gas industry should be reorganized had, he said, been the subject of some criticism, but there was genuine appreciation of what he had done. The Institution acknowledged with gratitude his benevolent attitude towards its affairs, and especially the support which he and the members of his Department had given to the endeavour to raise funds for the Institution's new headquarters.

The **Right Hon. Hugh Gaitskell,** responding to the toast, said this was the first time he had had the opportunity of meeting the leading technicians in the gas industry, and he was very glad to be responding on behalf of the guests. He could not speak about all the guests, but would like to refer to one particular class, and that was the guests from overseas, and on behalf of the Government he would like to add a word of welcome to them. They were delighted that there should be these technical men from other countries who sought to discuss their common problems with the people in the industry in this country, and that the proceedings should also be attended by representatives of foreign and colonial Governments. He hoped they would find it a profitable and useful occasion.

Need for Change Recognized

"It is a fact, as the President has said," proceeded Mr. Gaitskell, "that certain changes in the structure of the industry are about to be made, and a good deal of my time and the time of my advisers has been spent on this matter. Most people, and I think most people in this room, probably agree with me when I say that the need for some changes in the structure of the gas industry is not really disputed by anybody. It has been universally recognized that the present business framework of the industry is not calculated to produce the best results from the point of view of the community; and it is not calculated to give sufficient opportunity for the technicians in the industry to make the best use of the very considerable knowledge and experience they possess; and it is not calculated to give us the type of set-up which is needed."

Practically everybody agreed that there was a need for a much greater degree of integration, or, if they liked, larger administrative and executive areas. That matter was really not in dispute. One of the weaknesses of the small unit was that it could not afford sufficient specialized activities; and it was a virtue of the larger unit of management that it could afford such specialized activities, and of course research was one of the most important of all.

"We most sincerely expect that as a result of the changes which are to be made there will be very considerable extension of the research work that is done on carbonization. We must see that this research work is properly co-ordinated with the work that is being done in other fuel and power industries. You have obviously a very close interest in the work which may be done by the National Coal Board, and I was very pleased that you invited Sir Charles Ellis here last year, as you have done again this afternoon, because we have to ensure that the work done by the Gas Industry and that which is done by the National Coal Board shall be properly brought into line."

Most people would agree that, granted the need for larger areas and some measure of integration, to leave the matter purely to voluntary action on the part of company and municipal undertakings would not really produce the results that all agreed were necessary. Certainly some measure of amalgamation had taken place with, he thought, considerable advantage; nevertheless it had only been a small amount of what was really required. So long as matters of that kind were left to voluntary action they were held back by having to satisfy everybody, and that meant having to satisfy one particular authority or undertaking which might be obstructive; by having all the time to accept the lowest common denominator as the criterion of their work.

Powers of Area Boards

"We did not feel that was good enough, and therefore, following the report of the Heyworth Committee, we made our own particular plan for transferring the industry to public ownership and placing the management of the industry in the hands of Area Boards. We have at times been criticized, rather surprisingly, I think, for concentrating the management so much on large Area Boards and not setting up a powerful central authority. I remain convinced that the plan we put forward was the right one. I do not think that in the gas industry there is any occasion for a powerful central authority with special, widespread powers over the Area Boards.

"I think further that in arranging that the Gas Council should consist of the Chairman and Deputy Chairman independently appointed by the Minister, and otherwise consisting of the Chairmen of the Area Boards we have done something which is very wise, because you have there a federal body, a democratic body,

and one of the great safeguards of the Area Boards from any encroachments that the central authority might otherwise have made is the fact that the central authority itself is to all intents and purposes composed of representatives of the Area Boards.

"Some people, including a section of the Press, have described the arrangement as farcical, because they contend that the Chairmen of the Area Boards can do no work apart from the Central Council. Nobody would say that because the present British Gas Council consists of members of a number of affiliated bodies—men holding executive positions in individual undertakings—it has not performed very useful functions. It seems to me to be quite absurd to say that you cannot have a central authority composed of members who have other jobs to do in their own areas.

Further Decentralization

"You must have at the centre some additional element, consisting in your case of Mr. Sylvester and Colonel Smith, but for the areas I think this federal and democratic arrangement is rather a good idea, and I take some pride in it. I want to say one other thing about the structure of the gas industry. You may feel that the number of areas is too small and that their size is too large. As a matter of fact we added two to the proposals set out in the report of the Heyworth Committee, making a total of 12 against the 10 recommended in that report.

"I suggest that it is really a misconception to attach too much importance to the number and size of the Area Boards. These Area Boards will almost certainly—though we are not dictating to them—feel that they ought to have sub-units or areas of management. I cannot conceive that they will themselves, as Area Boards, concern themselves with the day-to-day details of management. They will have to make out and apply the appropriate structure for their own area requirements, and as I have said in the House and now emphasize again, there is not necessarily any reason for anticipating over-centralization because you have a large area. You can have a small area with a very over-centralized structure within it; or you may have a large structure with a very de-centralized arrangement within it. It is up to the Area Boards to decide their own structures. They will, I think, try to avoid any attempt to over-centralize. Local needs will almost certainly be met by the existence of smaller management units.

"I do not mean to suggest that there will be no changes whatever in the local structure. There will be change, and probably the most important thing about the change is that a lot of people who have hitherto been working on their own will in future be working in a larger team. I am not meaning to suggest that these people, through the Institution of Gas Engineers and in other ways, have not had most excellent relations with their colleagues in other undertakings. But there will be a new relationship; they will be in the same show, and they will have to work in a team together. Learning to work in a team may impose some strain on individuals.

"We talk a lot about team work and we pay our tribute to it and recognize the importance of working in a team, but the individual does not always come into the team all at once. It takes time to set up the right sort of tradition and to establish the right sort of relationship. When we are dealing with human beings between whom there has to be established a new relationship we do not expect that everything will run smoothly from the start. In the last resort human beings have got to establish a different sort of relationship with one another.

Very Little Anxiety

"I really have very little anxiety about the new plan, and about how it will operate, particularly in your industry, for a number of reasons; firstly, because, perhaps naturally, I think the plan of public ownership under the new structure as a good one. I do not ask everybody to agree with the change. There have been disagreements in the past, but I believe it to be true to say that, granted that you are going to have public ownership, an overwhelming majority of opinion in the industry is in favour of the new structure, and is satisfied that within the framework imposed by Act of Parliament—and it is a very wide framework—the plan provides a good solution to the problems in the industry.

"A second reason for feeling reasonably satisfied is that in the gas industry you have had for many years a strong tradition of service to the consumer, and that is something that is going to be immensely valuable in the new set up. A third reason, and perhaps the most convincing of all, is the industry's record of practical achievement in the past 10 years.

"You have had to cope with an enormous expansion in the demand for gas at a time when it was practically impossible to increase your capacity. I know only too well the difficulties with which you have had to contend. I know only too well how many undertakings have had to make-do and mend all the time. I know how, to-day, the shortage of steel is impinging on you; nevertheless, service to the consumer has, except in a negligible minority of cases, been maintained throughout, thanks to the devoted service of the people in the industry. I would like to congratulate you on your achievement.

"I have only one other thing to say, and that is a word about the relations between the Ministry and the Institution. I think you know that under the new set up it is not the intention of the Ministry to interfere with the detailed management of the industry; but under the Bill certain functions which have hitherto been performed by other people will pass to the Ministry. Some of those functions are of a technical or semi-technical nature, and I am very glad that the Institution have been good enough to promise me every assistance in performing those functions. I shall take advantage of your offer and shall not hesitate to come to you for your advice and assistance whenever it is necessary. I have heard with pleasure of the initial success of your financial appeal. I have no doubt that you will not only be successful in that direction, but that as an Institution you will be successful in all the other matters you have mentioned.

"The President referred in his speech to the concept of social engineering and suggested a lot of fascinating trends in which one might apply it. The Gas Bill is a piece of social engineering, and if the members of the Institution of Gas Engineers will follow your advice and take an interest in these things, as they do in their more technical problems, nothing but good can come from it. I congratulate you on your 85th birthday. I hope you will pass the century mark happily before long, and go on to even greater things in the future. I thank you very much for inviting me this afternoon, and on behalf of the guests I should like to thank your President for a most stimulating and interesting address."

Sir **Henry Tizard,** K.C.B., A.F.C., F.R.S., President of the British Association for the Advancement of Science, proposed the toast of "The Institution of Gas Engineers," and quoted some little known passages from the Royal Charter granted to the Institution in 1929. One of the objects defined in the Charter was "To enable persons who are or have been engaged in the conduct of gas undertakings, or who have been regularly educated as gas engineers, to meet and to correspond." All of them knew the great value of meetings such as they were now holding, with the presentation and discussion of papers, but there was an equal value in discussing matters in private, and in corresponding subsequently. Another object was "To encourage the acquisition or diffusion of knowledge," and one wondered whether they were doing all they might in the matter of diffusing knowledge to-day. The real trouble was not so much in the acquisition of new knowledge as in the using and diffusing of that knowledge which already existed.

The gas industry had passed through many vicissitudes. For many years it met with no effective competition, and towards the end of the 19th century it became self-satisfied and supine. Then electricity came in as a competitor and put new life into the work of the gas engineer. That competition had resulted in great benefit to all. Now they were told that the gas undertakings of this country were to be brought under new management, and the new management would be the same as the new management of the electricity industry. Would competition disappear under those conditions, and if it disappeared would something better take its place? There was something better, in which the Institution could take its part; he meant the spirit of emulation and co-operation. He was of the opinion that great advantages might be obtained by the co-operation of the gas and electricity industries, and the Institution might help to bring that about.

Mr. **E. Crowther** (President-Elect), who responded, thanked the members for the honour of being appointed to the highest office the Institution had it in its power to confer. He prized it the more because his father was for many years a member of the Institution. In his view the Institution was one of the most coherent and most friendly chartered organizations of its kind in the country, due to some extent to its relatively small size compared with some of the larger Institutions, but also to the common ideal of service. For 85 years the history of the Institution had shown that, while not seeking the limelight, it had brought about advances in engineering and in the professional standing of those practising the profession of gas engineers, and he believed it had done that work to the advantage of the industry, of the nation, and of themselves.

Mr. **J. F. Davies** (Chairman, Radiation, Ltd.) proposed a toast to the retiring President, Dr. Harold Hartley, who, he said, had in a most unselfish manner served the industry by working almost day and night. He had travelled from district to district conferring with the local people and ascertaining their views, and as a result of acquiring that knowledge he had come back to head office a wiser man. His outlook had changed from what it was a few years back, due to the position he had held this year as President. Whatever nationalization had in store for the gas industry, they had in their organization eminent men of great ability able to provide new ideas. Doubtless nationalization might be the right thing, but nationalization without co-operation could not succeed any more than any other system.

The **President,** replying, said there was little to add to what had already been said. He was very proud when they elected him as President, and he had enjoyed his year of office. It had been a strenuous time, but he had made many friends, and he agreed with Mr. Davies that he had benefited greatly from this year of activity.

THE DEVELOPMENT OF THE GAS INDUSTRY IN THE NETHERLANDS*

By G. A. BRENDER À BRANDIS
Professor at the University of Delft, and President of the Vakgroep Gasbedrijven, Netherlands

Professor Brender à Brandis

IT has been a great pleasure to the Author to comply with the request of the President of the Institution of Gas Engineers to say something about the development of the gas industry in the Netherlands, and he considers it possible that his views on the future of the Netherlands gas industry may also be of some interest in regard to conditions in the British gas industry.

It is proposed to divide the history of this development into three parts, viz., as it concerns the past, the present, and the future.

The Inventor of Gas

A Dutchman, Jan Pieter Minckelers, deserves the honour of having discovered the production of gas from coal. He was born in Maastricht on Dec. 2, 1748, and studied at the University of Leuven, where he was appointed professor of physics when he was but 23 years old. In 1782, the brothers Montgolfier were first to raise a balloon by means of heated air, while in August of that year the scientist Charles, in Paris, raised a balloon filled with chemically prepared hydrogen. This led to the search for suitable and cheap gases for the filling of balloons, and Minckelers took this work in hand with great energy.

In an elaborate publication entitled "Mémoires sur l'air inflammable," Minckelers states that on Oct. 1, 1784, he obtained a great volume of " inflammable air " by heating crushed coal in the barrel of a rifle (being as much as 10 cu.ft. from 400 g. of coal), which gas, when weighed, appeared to be much lighter than the air of the atmosphere. He furthermore published tables of gas yields from other materials, such as wood, peat, rapeseed-oil, &c. In addition to noting this low specific gravity, he found that the gas, which he still called " inflammable air," burnt with a luminous flame, and as early as 1785 he lighted his lecture room in Leuven with gas derived from coal. A reprint of this publication, and an old engraving representing the old lecture room with Minckelers lecturing ,are still to be seen in the library of the Netherlands Gas Association.

In England, William Murdoch is looked upon as the discoverer of coal gas. A memorial tablet on the house, at Redruth, Cornwall, where he was living at that time, states that he invented gas lighting there in 1792. Minckelers has, therefore, a priority of seven years and must be considered the first inventor. It is, however, quite possible, and even probable, that Murdoch was not acquainted with the invention of Minckelers, and in that case his personal merit holds good and we can rightly admire his genius.

After the lighting of his lecture room with gas, little is known about Minckelers further developing or applying his invention, and, therefore, England has unquestionably earned the glory of being the country of origin of the gas industry as such; where also, as far as is known to the author, the first application of gas to public service took place —viz., the illumination of Westminster Bridge in 1802 on the occasion of the Peace of Amiens.

From England, the gas industry was established on the Continent of Europe, in connexion with which the Imperial Continental Gas Association, in particular, played a great part. In the Netherlands this Association acquired concessions for the founding of gas-works in Amsterdam, Haarlem, and Flushing, which have lasted until the commencement of this age. They were conducted in an excellent way, for both shareholders and gas consumers. The beginning of gas production from coal in Amsterdam, the first gas-works in the Netherlands, dates from 1826, in which year, also, Rotterdam commenced gas manufacture. At first the gas-works were mostly run by private persons, or by limited companies, as in Amsterdam, Rotterdam, Utrecht, Haarlem, Arnhem, &c., but gas-works were also started by municipalities as public utility services. In the course of the years the private undertakings were gradually taken over by the community, so that by about 1900 but few gas-works were still privately owned.

This development shows a great difference from that in England, where, until recently, gas undertakings were big concerns largely in the hands of private persons. As in the case of the public utilities in the Netherlands, they operated the distribution of gas in an excellent way and certainly in the interests of the consumers, their aim being to give an adequate service.

Now a very remarkable thing is taking place. After the recent war the British gas industry, which operated so efficiently, is to be taken entirely out of private hands and is to be nationalized. In the Netherlands, where municipal control has been the general rule for a considerable time, there is a tendency towards the opposite direction. This does not signify that it is intended to put the gas industry entirely into private hands again, but there is unquestionably a tendency to entrust the operation of gas manufacture to limited companies. Although the shares will be held largely by the Government, participation of private undertakings will certainly not be excluded. For this tendency the following explanation is evident:

The era wherein were established a multitude of large and small gas-works is drawing to a close. Everywhere there is a tendency to concentrate on large undertakings, whether combined with chemical industry or not. Such large concerns cannot very well be conducted directly by the community. The Netherlands gas-works of yesterday and to-day was, or is, essentially a municipally controlled service rather than an undertaking. Such a works is run by a manager, who is more or less responsible for its operation, subject to the more or less liberal ideas of the particular municipal authority; but in the last resort decisions are taken by the municipality, which in its turn is influenced by political parties. The gas-works of the future will be a real chemical undertaking of considerable importance—not so much a gas-works in the narrow sense as a complicated chemical refining plant, which should supply not only a municipality, but an entire district with gaseous energy.

In a very precise and typical manner, the above has been depicted in a few words by the author's colleague (Professor Dr. F. K. Th. van Iterson), President of the Netherlands State Commission appointed to advise the Government on the concentration of gas supply in the Netherlands. He said: " Technical science is a living organism. Only those undertakings with wide connexions and in a position to change their tack easily when the wind changes, should now undertake the production of gas."

Before studying the development of gas production in various works it would be as well to consider some particulars about the total gas consumption in the Netherlands from the year 1900 to date. These are shown graphically in Fig. 1.

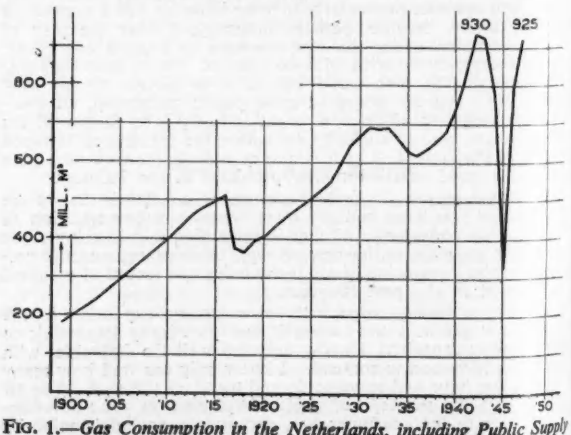
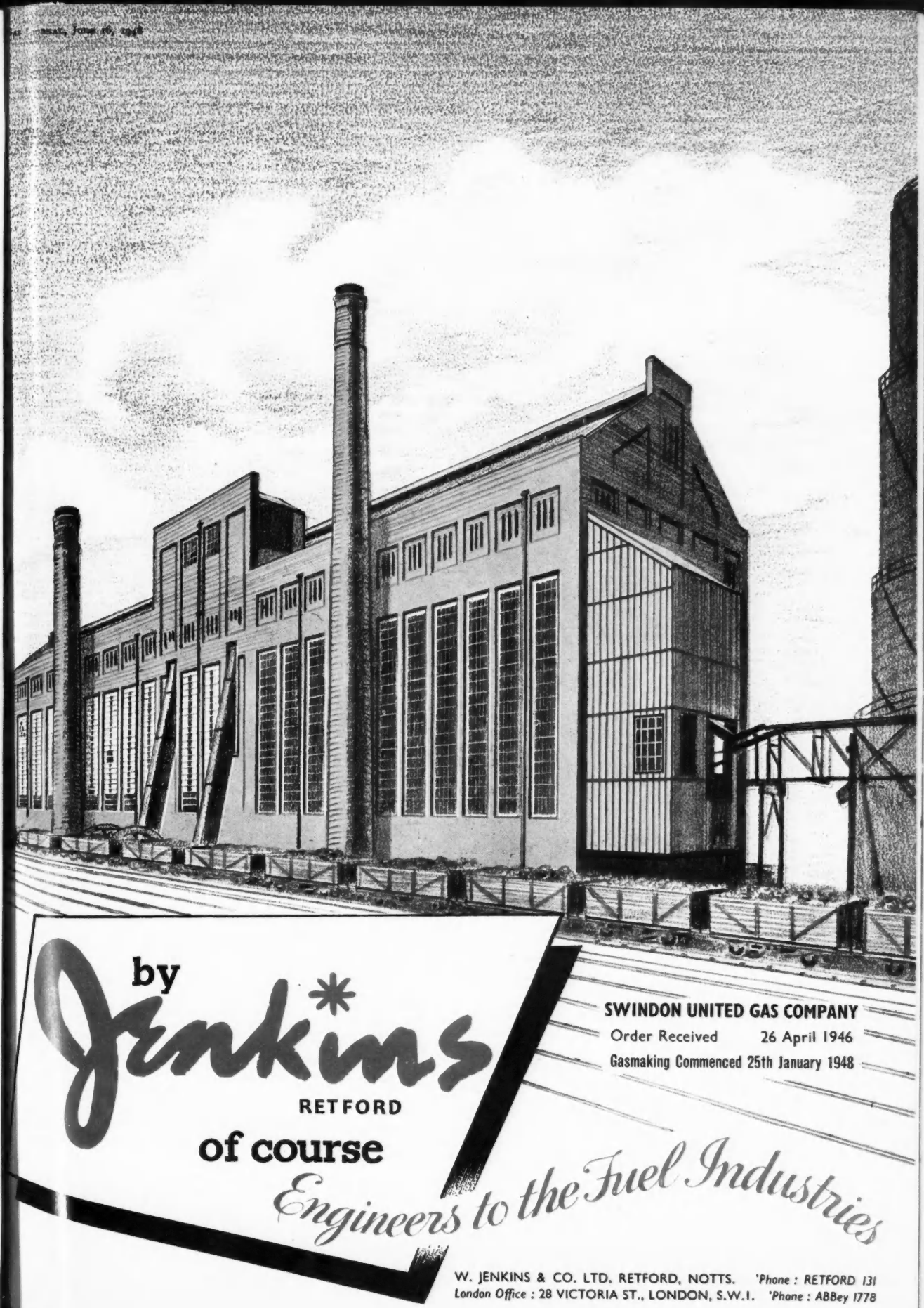


FIG. 1.—*Gas Consumption in the Netherlands, including Public Supply from the States Mines and Blast-furnaces, from* 1900 *to* 1947, *in millions of cu.m.*

* Communication No. 333 of the Institution of Gas Engineers, presented at the Annual Meeting, June 8, 1948.
1 cu.m. at 15° C., 760 mm. dry = 35.91 cu.ft.
1 cu.m. at 15° C., 760 mm. wet = 35.31 cu.ft.



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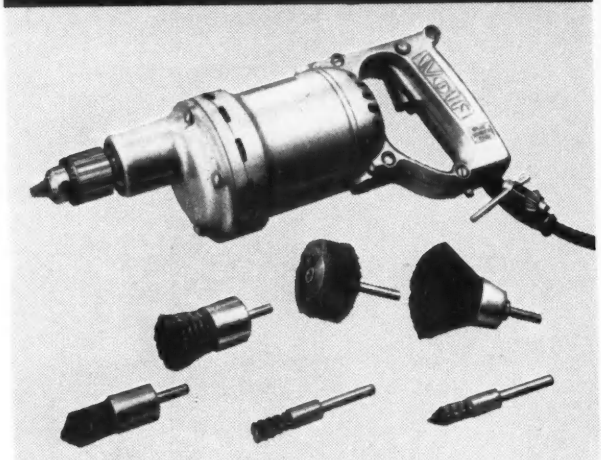

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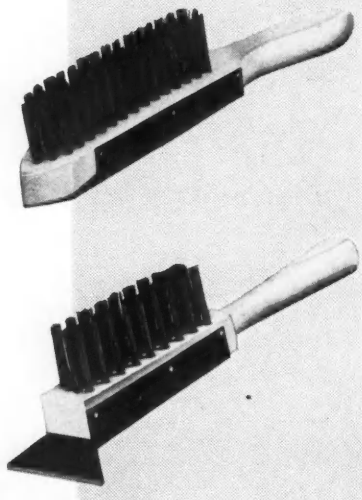

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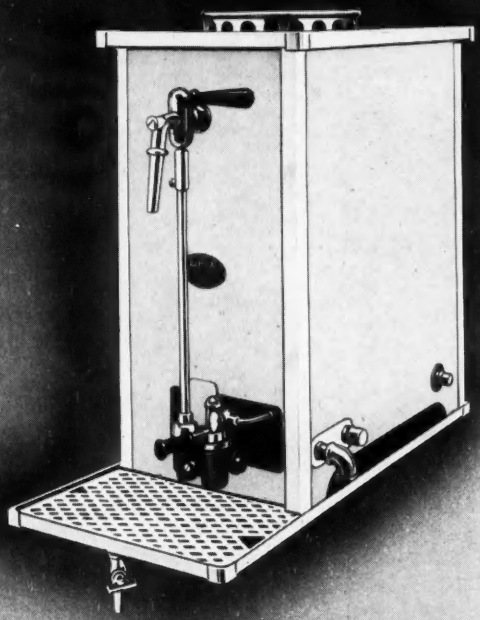

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The graph shows a total consumption of 200 million. cu.m. per annum in 1900, increasing regularly and considerably up to nearly 1,000 million cu.m. in 1947, which figure will probably be reached in 1948, if no unforeseen circumstances occur.

The rising line in the past 50 years has been drastically interrupted on three occasions: first, by a marked decrease during the war of 1914-18, then by a less important, but still considerable, decrease during the economic crisis in the years 1933-35, and finally an exceptionally sharp decline during the recent war, when, in the northern part of the country (viz., north of the large rivers), all gas-works were closed down in the terrible winter of 1944-45. The fact that gas consumption at that time did not fall to nil can be explained by stating that the southern part of the country was then already liberated, so that in that area gas production could continue.

The notably rapid recovery after the war demonstrates conclusively the great and vital strength of the Netherlands gas industry. It should not be forgotten that this quick recovery has been taking place while gas is still rationed in the country.

About 1930, the total number of large and small gas-works was about 200. To-day this number has decreased to about 140. This decrease in number is not, of course, an indication of decline, but of modernization. The coke ovens of the Netherlands State Mines commenced operation in 1921, in a very modest way, with localized distribution of gas. The supply for public purposes from the State Mines amounted to:

Year	Million cu.m.
1930	18
1940	100
1947	140

In order to avoid giving a wrong impression of the importance of the Netherlands State Mines, it should be understood that the above figures represent only a small part of the total gas production of the coke ovens. The nitrogen-fixation plant alone at present uses about 330 million cu.m. of gas per annum.

Owing to the supply of gas by the State Mines a considerable number of gas-works in the southern part of the Netherlands have disappeared. The high-pressure distribution mains of the State Mines now have a length of 306 km. (190 miles), and important orders for new steel tubing have been placed.

During the same period the more important gas-works gradually absorbed the smaller ones in their vicinity. One may say that centres of growing production crystallized out of the great number of small units: also, the coke ovens associated with the blast-furnaces at Ijmuiden, due west of Amsterdam, commenced supplying gas and formed a new network for distribution to the gas undertakings.

The Present

The present position of gas distribution in the Netherlands may be seen from the map (Fig. 2). It will be seen that centralization has already taken place. Many producers have extended their distribution mains considerable distances from their associated centres of production. Nevertheless, it is not yet possible to speak in the Netherlands (and the author believes that the same applies to England) of a real concentration of gas production such as has taken place, for example, in Belgium and Germany. It is not a simple matter to give clearly defined reasons for this backwardness, and, therefore, the author would prefer not to venture too far on this subject. In both the Netherlands and England the present situation is due partly to a certain degree of conservatism, but other reasons are also possible. England possesses large coal resources, and before the war had unlimited quantities for disposal, which, moreover, were available in many different parts of the country. In the Netherlands coal is to be found only in the extreme south of the country. Coal for use at gas-works has, however, been imported almost exclusively from England and Germany. Owing to the large number of excellent waterways in the Netherlands the cost of transportation was very low, and when a ship carrying German coal was once on its way, or when a cargo of English coal in a sea-going vessel had been discharged into lighters, it was a small matter to convey this cargo a few kilometers further. The author has calculated that in the Netherlands the transportation of coal over good waterways works out cheaper than would the amount of interest and depreciation if gas distribution were made through mains, to which the cost of compression of the gas must be added. (It is not possible, however, to go into details here.) Further, gas distribution would entail the conveying of other solid fuel, mostly coke, to the place where otherwise the gas-works would have been the producer of coke.

However this may be, both the Netherlands and England are, rightly or wrongly, somewhat tardy as regards large-scale concentration of gas production.

Doubtless, the recent war is also one of the causes of this state of affairs. The Belgian and German gas industries had almost completed concentration just before the Second World War broke out. They had been able to build new systems during a period of low prices for pipes and other materials. Had there been no war, the Netherlands gas industry would certainly have progressed considerably on the road to concentration during the last eight years. Owing to the prevailing scarcity of materials, to high prices and shortage of foreign currency these plans are notably more difficult to carry out and will take much more time than before the war.

The Future

The future development of the Netherlands gas industry is a subject in which reference should be made to what is anticipated and considered desirable, although it must be emphasized that the author is not yet in a position to quote established facts or decisions. The general opinion certainly is that the future will bring centralization. The advantages are obvious. The fact, just mentioned, that the transportation of coal may be cheaper than that of gas, is of secondary importance. In large undertakings the cost price of gas is lower than that of smaller concerns, and it is further important that large production centres can supply gas of good and, particularly, constant quality. In the future, industrial gas consumption will play an increasingly important part, and constancy of quality is an absolute necessity for industry even more than for the domestic load. On the whole, gas-works in the Netherlands are approaching their maximum capacity, chiefly due to their being in a very bad state of repair, and also to renewals and enlargements having had to be deferred on account of the war. If, therefore, a change is to be made, now is the time for reconstruction, even if other conditions, such as prices and delivery times, are not at all favourable. The transition, however, is difficult and will require time. It would be simpler to devise an entirely new system in a country where there was no gas at all, than it is to reconstruct an existing system.

FIG. 2

It should be understood that the object of this new system is not that a futher number of the smaller gas-works will disappear, but that nearly all the gas-works will in the long run cease to exist.

One is now faced with the question: Should gas supply in the future be effected by a few very large undertakings, or is it advisable to keep this number somewhat higher? To put it more precisely: Should there be, for example, five very large units (or, to be still more precise, four, and a considerably less important plant for the north of the country), or nine or 10 which would still be considered large undertakings? The transition from 140 works to either five or 10 remains in any case considerable and very drastic. By very large units is meant those which can carbonize 3,000 to 5,000 tons of coal per day (24 hours); by large undertakings, those which can deal with, say

1,200 to 1,500 tons per day. Both plans have their adherents. An attempt is made below to show as objectively as possible the advantages of the very large plants, and in addition the arguments for constructing and maintaining a somewhat larger number of less extensive undertakings. One cannot deal here with all possibilities, as the problem may be considered from various angles and is very complicated.

(A) Comparison of Systems

When comparing the two systems, as few figures as possible will be used. Ever since their college days engineers and constructors are accustomed to calculating and expressing everything in figures. From figures they draw conclusions, and maintain that figures form a reliable basis for this purpose. For many types of calculation this is certainly and fortunately true; for example, for the estimation of yields, strength, and efficiency.

For economic purposes, however, it is inadvisable to take figures only as a basis, just as great care should be taken to arrive at statistical conclusions. Very important factors often cannot be expressed in figures, or, when this is done, these are often founded on assumptions which are sometimes entirely arbitrary and, therefore, apt to be unreliable. For decisions and judgments of an economic nature—and gas concentration is far more an economic than a technical problem—considerations and views which cannot, or can hardly, be expressed in reliable figures play a part. If it be the intention to meet the Netherlands future demand for gas by a small number of super-undertakings, then probably two more manufacturing stations would have to be built, and a smaller unit for the north of the country.

(B) Advantages of Super-stations

The following arguments are put forward to demonstrate the advantages of very large units:

(1) According to calculations made the cost price of their gas is lower.
(2) They are better suited for combination with chemical industry, by which a nitrogen-fixation plant in particular is meant.
(3) A nitrogen-fixation plant connected with a gas manufacturing plant will also produce fairly pure oxygen. This will in the future very probably be utilized for continuous gasification.

Should these advantages be found to be correct, the second system involving the construction of large undertakings, but on a smaller scale, seems to be excluded. Nevertheless, this system also offers certain advantages. Before going into particulars, it is necessary to say something about the cost of gas in general. This depends on many factors. A very important factor is the size of the plant, which can be expressed by the quantity of coal carbonized in 24 hours. Next to this, the oven system plays a part, and then again there is a connexion between the quantity of coal treated and the oven system to be chosen. No sensible expert will choose for a plant of moderate dimensions the horizontal chamber oven with pushing-machine, known as the coke oven type. When dealing with a moderate quantity of coal per day the costly coke-pushing machine, as well as the shift of labourers, are uneconomically used, which of necessity will influence the cost unfavourably. For the coke oven type it is reckoned that the most favourable result begins when treating 1,200 to 1,500 tons of coal daily. This can be dealt with by one pushing-machine and two shifts in 16 working hours. When treating 2,000 tons daily, the price of gas does not work out lower, but perhaps somewhat higher. Therefore, 1,500 tons forms a kind of unit, and it seems logical, if enlargement becomes necessary, to go at once to 2,400 to 3,000 tons, adding a new unit in doing so. Up to about 1,2000 tons of coal daily the vertical chamber oven is a competitor, whether continuously operating or not. Personally, the author is inclined to prefer the continuously operating chamber to the intermittent vertical type, for its regular working and constant quality of gas and its favourable thermal yield by quenching the coke with much less production of steam. It should not be forgotten that the continuous vertical chamber oven operated with gas coal and an adequate steam supply to the bottom of the chamber can produce 25 to 30% more gaseous calories from a ton of coal than the coke oven produces from coking coal. It goes without saying that this is a considerable advantage in a weak coke market, while it also means that, at a time of coal shortage, 25 to 30% less coal is required to produce an equal quantity of gaseous energy.

From its very nature the very large undertaking will choose the coke oven type, the somewhat monotonous series of horizontal chambers. For the lesser units the continuously operated chamber oven may also be considered.

(C) Advantages of Moderately Large Plants

(1) For coke ovens the right type of coal is a "fat" coal. If gas production is to be operated more and more on coking coal, this will probably become more scarce and will fetch a higher price than good quality gas coal with, for example, 32 to 34% of volatile matter. It is even conceivable that sometimes the coking coal required will not be available at all, as would at present be the case in the Netherlands. One may therefore be thankful that at present so many gas-works still operating in the country can use coal with more volatile matter and less caking power. In these circumstances it is quite conceivable that a gas-works which can use cheap coal could supply gas at a lower price than is calculated on paper for coke ovens.

(2) Coke ovens mainly produce hard, so-called metallurgical, coke, excellently suited for blast-furnaces, foundries, &c. The great number of small consumers, however, much prefer the easily combustible gas coke. It is possible and even probable that the future will again bring periods of overproduction of coke, and then it is, of course, a great advantage if the producers of gas supply to the market hard as well as easily combustible coke. It need not be demonstrated here how strongly the cost of gas is influenced by the margin between the prices of coal and coke. The coke oven is more sensitive to this influence than the gas plant, which gives a smaller yield of coke per ton of coal.

(3) The smaller the number of production centres, the more gas has to be conveyed over long distances. Naturally, this will cost a certain amount which may be expressed, for example, per 1,000 cu.m. and per km. It is still more important that the peak load has to be conveyed over a greater distance. One is speaking now not so much of the daily peak load, but, especially, of the seasonal peak load. The interconnecting mains and compressors, now so costly, should be capable of conveying the very large gas consumption of one single extra cold winter week, and would therefore not be utilized fully during the remainder of the year. If the system of a larger number of production units is adopted, then not so much is demanded from the mains. Consideration has been given to maintaining at various points water gas installations to meet this seasonal peak load, but, when they are used for such a low annual production, they will supply very expensive gas. Moreover, the author considers it to be a disadvantage that water gas production should change the composition of the gas to a considerable extent. It should be possible to maintain the same calorific value, but the other properties of the gas, such as the quantity of air required, the combustion velocity and the specific gravity, are radically different. Herein lies one of the advantages of central gas production, in so far as the very constant quality of the gas is seriously jeopardized.

(4) What about the combining of gas plant with chemical industry? Plants which can carbonize 1,200 tons of coal daily are surely capable of maintaining adequate gas purification, by means of electrostatic purification, or intensive cooling and adsorption with active carbon. Benzene and toluene can be obtained, both refined and fractionated. The tar can better be dealt with in one or two central distilleries. These must co-operate with producers of energy, as, for that matter, they now already do. The transportation of the tar, when properly organized, need not be costly and is negligible in comparison with the extra quantity of coke to be transported from the small number of super-undertakings. The fixation of nitrogen is a different matter and cannot very well be combined with a plant carbonizing 1,200 to 1,500 tons of coal. This, however, does not seem a great objection to the author. The purpose is the construction of large economically working energy-producing centres, capable of recovering all by-products and of supplying well-purified gas of constant composition. Nitrogen fixation may become a doubtful addition to such undertakings. Only 13 years ago the world was encumbered with a considerable surplus of fixed nitrogen. During the recent war the capacity of nitrogen production greatly increased. Within a few years the market will be saturated, and then there will again be a possibility of over-production. One can certainly argue that China, for instance, could use millions of tons of nitrogen a year and that it will therefore remain an excellent export product. The Netherlands State Mines will, in the coming years, continue to extend their nitrogen production, and the "Mekog," the nitrogen-fixation plant of the Ijmuiden blast-furnaces, is increasing its capacity to a considerable extent. After the home requirements are satisfied, a large amount will have to be exported. It does not appear illogical to suppose that one country cannot export more than another wishes to import, and the question is not whether China can use millions of tons of nitrogen, but whether the Chinese farmer lives in a country which is well enough governed to be sufficiently prosperous to pay for that nitrogen. Thus, for the energy-producing stations of the future, which will have to be financed largely by public money, nitrogen fixation is a somewhat

1 ton (2,240 lt.) = 1.01605 tonnes.

speculative undertaking. Then what, one may ask, of the nitrogen-fixation plant of the Netherlands State Mines? The principal difference between them lies in the fact that the State Mines raise their own coal and are therefore to a certain extent independent, while the other producers would have to buy their coal. One could therefore interpret the words of Professor van Iterson, quoted above, in this way: A ship can more easily change its tack when sailing alone than when dragging along a nitrogen-fixation plant!

(5) From a social point of view a dispersion of the labour potential of a country is to be preferred to a congestion of population in limited industrial areas. The latter gives less happiness in life, more difficult housing problems, and often requires the transportation of a multitude of labourers over great distances, with consequent uneconomic expense. It should, further, not be lost sight of that in times of social unrest, and even, perhaps, of riots, a larger number of gas production centres is to be preferred to a few very large units which can more easily be taken possession of by disturbers of social order. The last advantage is, of course, of quite another nature and perhaps of less importance than the first, which concerns the availability of coal. Nevertheless, it should not be under-rated. The Netherlands gas industry is entering an entirely new phase. The transition to a new system will take a long time, so that the existing works, which are favourably situated and operate economically, will remain in being for a considerable time. The working out of the plans will, however, entail the taking of difficult, important, and, above all, very far-reaching decisions.

DISCUSSION

Mr. **F. M. Birks** (Gas Light and Coke): This paper was a joy to read and I found it quite the most interesting I have read for years. The implication that we should all stand back and view the situation so that we may obtain, if possible, some picture of the future, is a wise and statesmanlike proposal. One cannot but sincerely concur with the author's remarks as to the advisability of not always relying on figures as a basis for arriving at conclusions. Mathematics cannot be applied to the imponderables, and I would submit that any prediction of the future falls into this classification and not that of an exact science. It is very heartening to have this viewpoint mooted by the author because of the weight his opinion carries.

The concentration of gas production into a few large units is bound up with the problem of transmission. Fundamentally the distances which are economic are almost proportional to the calorific value of the gas. The long transmission lines now common in the United States could not, of course, be introduced into this country, even if the country was of a length sufficient to accommodate them, because the calorific value of the gas readily available here is only half that of natural gas.

So far as I have been able to ascertain, about 50 miles is the economic limit of transmission in this country, based on the differential in the cost of gas made from rail-borne and sea-borne coal, and this distance is less the nearer the demand for gas is to the coalfields. If such an assumption is only approximately correct, then there does not appear to be any great incentive to concentrate the manufacturing capacity into large works, although the present average size of works could with advantage be considerably increased.

Looking at the matter from the practical side, I think it is self-evident that there is not the manufacturing capacity for refractories, steel, and essential equipment to make a large-scale change-over possible for many years; such a long-term reorganization means in point of fact that during the course of time and changing of circumstances, there is likely to be a relatively slow but natural development.

One point on which I feel I must express some disagreement with the author is when he extols as an advantage of centralized production, constant specific gravity, and chemical composition of the gas, because I am of the opinion that when it is necessary to meet heavy seasonal demands, stringent tolerances as to these characteristics are most undesirable, and I would go further and say, such restrictions would eventually limit the growth of the industry. If the characteristics are such that they automatically reduce the thermal input of space-heating apparatus at times of excessive demand, then, because the duration of such a period is short, it is preferable to provide the equivalent capacity of plant. Having so reduced the thermal input, then the effect of this can always be partially modified by either increasing the pressure or the calorific value above the normal so far as the plant available permits. At least one keeps control of the situation.

I hope to have an opportunity this week of showing the author batteries of coke ovens in units of the size to which he refers, but which by reason of the use of alternative producer gas or rich gas firing are even more flexible with regard to the make of coke than any other existing type of carbonizing plant, but I must confess that this system entails a considerable capital expenditure, the charges for which in practice fall on the coke.

The plea for flexibility by the author when quoting Professor van Iterson, is very wise and the last few years have shown the advantage of a ship being free from barnacles so that its course can be altered rapidly and with certainty.

May I be permitted to offer my sincere thanks to the author for this valuable contribution.

Integration and Grouping

Colonel **W. Moncrieff Carr** (United Kingdom Gas Corporation): Professor Brender à Brandis has given us an extremely interesting paper. His observations as to the trend of control of gas manufacture in his country are of particular interest to many of us, and especially to those of us who have had some fears as to whether the gas industry in this country may become the Cinderella of the nationalized industries, and who fear that we may be operating more for the benefit of other nationalized interests rather than for the benefit of the gas consumers. Many of us in this country feel strongly that gas manufacture should be controlled and operated by the industry itself, and that when we take surplus gas from coke ovens under other ownership the cost of such gas should not exceed that which would result if the ovens were owned and operated by the industry itself for the purposes of gas supply.

The integration and grouping of the units of the industry in this country, as in the Netherlands, have taken place progressively over the past 20 to 25 years, and the acceleration of the formation of the holding company movement in the years 1932-34 greatly assisted in this work. Surveys carried out for the purpose of investigating the economics of integration indicate that centralization of production in many areas is quite uneconomic, whereas in those same areas benefits have resulted from grouping individual units under a central and uniform control, with the provision of central administrative and technical services such as cannot be provided by a single unit.

There are numerous examples of this type of grouping in the Company with which I am associated and in others. I would refer to one example, the York and Harrogate District Group of Gas Companies. This consists of six companies, individual companies each operating separate production and distribution systems, as it would be quite uneconomic to link them up physically. All are under central management, and each is provided with administrative and technical resources equal to those normally available only in the largest undertakings in this country.

I would again refer to my Company, which acquired 72 single gas undertakings, mostly in the years 1935-39, which are to-day operated as 13 groups of undertakings with a central management. There are only seven single units which are not grouped. This work of co-ordination has resulted in a large measure of success. Sales of gas have increased by 110%. The cost of management (which has been raised to higher efficiency) has been reduced by 0.6d. per therm on the average. The capital employed, notwithstanding considerable reconstruction and extension of plant, has been reduced from £820 per mil. cu.ft. of gas sold in 1938 to £469 mil. cu.ft. of gas sold in 1946, primarily, of course, due to extension of sales. Interest and dividend charges, of course, have been equally reduced.

There is a danger that in our planning we may lose sight of the most important consideration—and I am sure that the author will agree—namely, the cost of gas to the consumer. The author rightly points out that concentration is more an economic than a technical problem, and he appreciates that the economies resulting from manufacture in large central stations may be quickly dissipated in increased distribution costs. I would suggest that the cost of compression for distribution over considerable distances is to-day a very important factor.

I have made investigations into the cost of linking up where gas has had to be conveyed through rural and semi-rural areas, and in some instances I have found that the resulting increased cost in the gasholder at the receiving station would be as much as 100%, even after allowing for the lower cost of production in the larger station. It is clear that the soundest planning can be carried out only by areas, and the primary factors affecting the economics of integration are, as the author indicates, location of coal supplies and of coke markets; and to these I would add the important consideration of density of population and present and potential industrial loads.

In connexion with the author's remarks on the relative efficiency of different sizes of coke oven installations, as compared with vertical chambers, I made an investigation some time ago as to the cost of gas production in modern compounded coke ovens for a unit designed for a load of 2,100 mil. cu.ft., or 60 mil. cu. metres per annum. It showed that the coke oven plant would produce a lower cost than the chamber oven plant so long as the receipt per ton of coke are in excess of 82% of the price of coal per ton.

In conclusion, I would suggest that the Ruhr gas grid mentioned by the author, if constructed on the basis of values existing to-day, would be quite uneconomic. This development, which was carried out during the inter-war period, was largely determined by political and commercial factors other than the economics of gas supply.

and these considerations were further strengthened by the need to develop an outlet for the relatively large proportion of fine slacks produced in mining operations in the Ruhr coalfield. The yardstick of efficiency in the gas industry has been and must remain the cost to the consumer. We must have a cheap and abundant supply of gas.

I suggest, therefore, that our plans for integration in this country must commence not at national level, as suggested by the author for the Netherlands, but by district and area methods, and that the build-up of every unit which at present exists must be surveyed, and investigations made as to its potential industrial and domestic load; and no scheme should be embarked upon until its economics were proved from the point of view of cost to the consumer.

I should like to offer my personal thanks to the author for a very interesting communication.

Mr. **F. B. Richards** (Woodall-Duckham Companies): The valuable paper contributed by Professor Brender à Brandis could scarcely have been read at a more opportune moment for us in this country. Through the setting up a few years ago of the Ministry of Fuel and Power, and through the progressive nationalization in successive stages of the coal industry, the electricity supply industry, and the gas industry, a situation has been created wherein it is possible for the first time to formulate a national policy for the utilization of our limited and vitally important sources of indigenous fuel. I propose, therefore, to take as the text of my remarks the author's concluding sentence: "The working out of the plans will, however, entail the taking of difficult, important, and, above all, very far-reaching decisions." This expression of the author's seems completely apt to the present situation in which we find ourselves, when the formulation of a plan for the future development of the gas industry in this country, and for its correlation with the other branches of fuel supply, becomes practically possible.

The author weighs the pros and cons of the super gas producing station of very large capacity, say, 3,000 to 5,000 tons of coal per day, as opposed to what I may term the economic unit. I ought perhaps to define what I mean by the economic unit. When constructing a curve relating costs of production to capacity of works, one finds that in the first instance the curve of cost falls rapidly with increase in the size of the producing unit, but a point is ultimately reached where the curve flattens out and where further increases in size are not reflected in any material further decrease in cost. I have it in mind that the economic unit must be of such size that the cost of gas production falls on the flat portion of the curve. While agreeing with the author that this definition will apply to a works carbonizing rom 1,200 to 1,500 tons of coal per day, I believe, as some other speakers have indicated that they believe, that in British conditions this term may fairly be applied to works of considerably smaller size than the author has contemplated, say, down to 700 tons of coal per day, or 10 mil. cu.ft. gas.

In approaching the subject of planning the future development of the gas industry, it seems necessary first to determine what it is that the industry should set out to do. As I see it, this is to provide a convenient and economic heat service for public use, both domestic and industrial. It is common knowledge that the heat requirements in the climatic zone in which we and the author live vary enormously with the seasons, as between winter and summer, quite apart from variations from day to day. Gas cannot be stored in the sense of meeting seasonal loads, and it is, therefore, necessary to have an extremely flexible method of operation in order to follow this varying load.

A Two-Fuel Industry

It seems to me, therefore, that the gas industry, at any rate for some time to come, should regard itself as a two-fuel industry, inasmuch as the solid product, coke, lends itself so admirably to storage in the summer to meet the winter peak. If we accept that, then the distribution of coke becomes a matter of equal importance with the distribution of gas, and the overall cost, as a previous speaker has said, must, of course, be our primary consideration all the time.

It seems, therefore, that in British conditions a number of stations of even smaller size than what I have termed the economic unit are likely to continue in operation for economic reasons, when the cost of transport of coal, coke, and gas is taken into account.

With regard to the type of plant to be selected, I am inclined to agree with the author that for the smaller units the vertical chamber system, whether continuous or intermittent, is likely to have claims to consideration. The advantages offered by each method are so well known that I do not propose to take up time by enumerating them. While coke ovens are likely to prove advantageous from the point of view of capital and operating costs in units having a daily capacity, as the author has said, of 1,200 tons and over, it is important if we are to secure satisfactory results from coke ovens to provide a coal supply which shall be constant in its grading, its moisture content and its coking properties.

It has been customary, in speaking of coke in the past, to divide it broadly into two classes, oven coke and gas coke. It is a popular fallacy that if one instals coke ovens in a gas works one produces oven coke, but I should like to emphasize what many of you know, and that is that if you wish to produce a coke which will be accepted by the market as oven coke you must duplicate the supply of the coal which has enabled oven coke to be produced in the coking industry. That does not as a rule fall within the region of coal supply which has been customarily associated with the gas industry in this country, and in planning any large extension of the use of coke ovens for the production of town gas it is necessary to visualize the effect of creating a largely increased demand for the type of coal which has been used in this plant in the past, in order to provide the product which is known as oven coke.

I think we shall all agree with the author that we have fears of seeing the gas industry, which should be flexible, tied on to the tail of a large-scale chemical factory, which of necessity, to be efficient, must be fairly inflexible. I have not seen so far any evidence that in this country overall economy is to be found by utilizing a process such as, say, the Lurgi process, which delivers gas at a high pressure and thereby tends to reduce the cost of distribution, which has already been referred to as being so important.

The author, in referring to coke ovens, suggests that the maximum economy can be obtained when operating plant of a capacity of 1,200 to 1,500 tons per day on a two-shift-in-16-hours system. I submit that that is rather hard on the coke ovens, and any coke oven operator knows that constancy of temperature in the battery is most desirable in order to secure the longest possible life. Further advantages of three-shift operation accrue through the constancy in the volume and composition of the gas produced.

In conclusion, I am sure that I shall be expressing the feelings of all of us when I say how much we appreciate the contribution of so eminent an authority on a subject which is of such special importance to us at the present time.

Mr. **E. Crowther** (Newcastle): In endorsing the appreciative remarks which have been made on this paper, I must bear in mind the injunction to be brief. As it happens, a number of the points which I intended to make have already been covered. It struck me how opportune this paper is, as it gives us an opportunity at the present time to compare and contrast our own situation with that of another country, and gives us, as it were, an independent viewpoint and a cross-bearing on some of the questions which confront us here.

In so looking at it, it became apparent at once that it is impossible, without a great mass of detailed information, which obviously could not be included within the scope of the paper, to express any opinion of value on one of the major questions confronting the industry in the Netherlands, that of the number of manufacturing units which should form the future basis of the industry and the territory to be served by each. Many of us have contended strongly that even in the light of our knowledge of our own country further survey work and collation of information should precede the definition of sub-area boundaries here, and would be desirable before even area boundaries are settled. The paper illustrates the wisdom of this view and the impossibility of planning soundly without the most detailed and complete information. It is evident that the author is of that opinion, and fully appreciates and understands the complexities of the issues involved in the preparation of a national plan, and the need for a close study of each feature before a conclusion can be reached.

It would be proper to make it clear to him that the approaching nationalization of the British gas industry does not imply any criticism of its efficiency. On the contrary, it has been commended repeatedly from all quarters on its performance. The need for integration has, however, been equally widely acknowledged, not least by the industry itself, if efficient progress and development are to continue in the future as in the past.

International Elimination of Small Manufacturing Units

It is interesting to note how the elimination of very small and uneconomic manufacturing stations is being carried out in different countries, according to the circumstances prevailing in each. In Belgium it is being done by gas transmission from the very large coke oven installations associated with iron and steel works in a highly concentrated area of heavy industry, where the coke produced by those installations is largely absorbed. In France it is being dealt with by the extended use of propane and similar products of oil refineries, transported in liquid form to the smaller gas-works, which continue in being as distribution centres only. In the U.S.A., it is done by very long distance transmission of natural gas, available very cheaply, and of high calorific value, at the oil fields, and the use of propane in isolated townships remote from main gas transmission lines.

In Great Britain, with a number of populous areas of diverse major industries, and with ample coal resources, local grid systems served by large gas-works, coke oven installations, and combinations of these are used, and one would anticipate that further progress will occur on similar lines, rather than by any radical replanning and reconstruction of the system such as the author appears to contemplate for his own country.

It is very interesting to note the relative consumption of gas per head of the population in the two countries, that of the Netherlands being about 40% of the British figure. The rate of increase in the past 40 years—in the Netherlands five times, in Great Britain three times—suggests that any plan for the former country should assume a further development at least of 100% in the next 20 years, and a still more rapid advance if the determined development of the industrial gas market is undertaken, an assumption which seems to have been made, to judge from the capacity of the stations discussed in the paper.

The author has not indicated to what extent it is anticipated that further large increases in public gas supply will be afforded from the ovens associated with the State Mines, or that these ovens will be extended to carbonize a greater proportion of the coal mined.

Without much more information it is impossible to assess the economies of diverting to public supply the coke oven gas at present used by the nitrogen fixation plant at the mines, though no doubt careful consideration has been given to this question and to the possibility of feeding the nitrogen fixation plant with synthesis gases produced from coke in water-gas type generators. This depends very largely on the point which Mr. Birks made, and which I fully endorse, that gas appliances in general are more tolerant of composition changes than at one time we were inclined to grant. We have learned how involuntary variations in one direction may be compensated by deliberate variations in others.

Should it be decided to employ the whole of the gas made by the coke ovens of the State Mines, supplemented with water gas as necessary, for public supply, at least half of the present gas requirements of the country could be met immediately from this source. The use of a part of the coke production of the ovens for the manufacture of water gas at peak demand times and of synthesis gas at other times would be a powerful means to control the coke market without involving heavy capital expenditure in long periods of idleness, while any shortage of coke either for metallurgical or commercial use could be met by importation of appropriate grades in part replacement of coal at present imported for carbonization.

There remains the question of relative cost of production in coke ovens and in gas retorts, which turns largely upon the ratio of coal to coke prices, which must be estimated many years ahead before a choice of plant can be made.

The author and his colleagues have an intensely interesting and important task in hand in settling the future national plan for the gas industry in the Netherlands, calling for the exercise of the highest degree of judgment and foresight. We wish them every success in their work, and look forward in due time to learning of their decisions and the considerations upon which these have been formed.

Reconstruction in the Netherlands

Mr. **H. R. Hems** (Birmingham): It is a privilege and a pleasure to comment briefly on this paper. I was very fortunate last year to have the opportunity of learning something of the development of the gas industry in the Netherlands. The impression which I gained was that the gas industry there is just as alive to its responsibilities and working as hard to restore its fortunes after the devastating effects of the war as the rest of the industries of the Netherlands and its people.

On the actual detail of the main scope of the paper, I must leave that to others to discuss, and to a large extent they have already done so, as my main interest when visiting the Netherlands was industrial gas. There are certain points of special significance contained and implied in the paper on which I should like to comment and on which I feel justified in asking for more information.

Two points of interest are the claim of the Netherlands to have produced the first user of gas, and the movement of the industry in England towards nationalization, with the rather reverse direction taken in the Netherlands, and the very significant statement by the author that the gas-works of the future will be a real chemical undertaking of considerable importance. I do not think that that is appreciated to the extent that it should be by people in this country.

The curve of rising gas consumption in the Netherlands, with the comment which the author makes on it, brings me to a point on which I should like to ask for more information. The author indicates, as Mr. Crowther has just said, that there is an increasing demand for gas, but from my angle, and I think from the domestic angle also, we should like to have heard more of the reasons for this and the likely lines of development in gas utilization in the Netherlands. In other words, I am asking for more.

The paper contains the implication that, as in this country, the industries and the householders in the Netherlands appreciate the gas service that the industry there is modelling. From the industrial angle, I had the opportunity of inspecting the workshops of the State Mines, in which the gas made in the coke ovens nearby was used extensively, thus demonstrating the overall economy to be obtained with gas utilization. Outside the gas industry, my only industrial visit was to the Philips lampworks, where gas is used to a large extent in the glass shops in connexion with the manufacture of electric lamp bulbs, radio valves, and so on. From conversations, I gathered that there are opportunities in the paint and varnish trades, bakeries, and in many of the new factories which are being erected in the Netherlands. I should like to know whether gas is utilized in greenhouses in the horticultural and fruit industries.

On the domestic side, while again referring to discussion No. 5 on the advantages of moderately large plants, and while agreeing with the author to a certain extent, I could not but be intrigued by the housing development which I had the opportunity of seeing, in the Hague and Rotterdam particularly. In the large towns, the Netherlands seem to favour the three-flat house, and unmistakably the housing arrangements fit in with the overall economy of the country, in which it seemed as though every square inch of available land was utilized for agricultural or horticultural production —something which we have yet fully to appreciate in this country. It would have been interesting to learn what gas equipment is being installed in the dwellings referred to. I feel that a study of the arrangements in these houses, with their special aspect of concentration adopted by the Netherlanders, would provide a very valuable basis for comparison between the provision of heat services by gas and/or electricity with a centralized heat supply.

I cannot conclude without referring to my admiration for what I saw on a visit to the central laboratories of the State Mines, for their ideal situation, the buildings, the work being carried out, and the excellent arrangements made for demonstrating to visitors, and particularly non-scientific visitors, the work being done. This is necessary there, and that again illustrates the interest of the Netherlander in his State Mines, because large numbers of visitors make the journey to the mines and laboratories every year.

GENERAL MEETING OF THE INSTITUTION BENEVOLENT FUND

The general meeting of the contributors to the Benevolent Fund of the Institution was held on Wednesday, June 9.

The **Chairman** (Dr. Harold Hartley) moved the adoption of the Report of the Committee of Management of the Fund for the year 1947-48 and Accounts for the year 1947.

Dr. Hartley explained that they were doing fairly well with regard to the Fund, but they ought to do better. During the year he had attended Association meetings, and he thought it had happened invariably when he had been there that the meeting had voted its subscription to the Fund.

He appealed to all present as subscribers to act as ambassadors.

Mr. **W. S. Hubbard** (Liverpool Gas Company), in seconding the motion, remarked that until three years ago he had merely been a contributor to the fund. Since then he had had the pleasure of assisting the Committee and had had the opportunity of really seeing the splendid work which was carried out through the contributions.

Mr. **C. R. Ingham** (Cheltenham) said he was happy to take the opportunity of thanking the Committee of Management of the Fund. Charity, he said, was a manifestation of loving kindness, and it was in that way that the Benevolent Fund of the Institution was administered.

The **Secretary** (Dr. W. T. K. Braunholtz) read the report of the Scrutineers, which stated that Mr. J. T. Haynes and Mr. G. P. Mitchell had been elected to serve on the Committee of Management for the next three years.

Mr. **F. W. Sansom** (Exeter) said the report which has been presented by the Committee of Management indicated the valuable work being done to alleviate many cases of personal hardship. It was in accordance with the highest ideals that a professional body such as theirs should, in addition to its normal technical functions, also sponsor such a fund as this. To this end it was necessary to have not only contributors, but some body to administer the funds. In regard to contributions, it had been mentioned that, although the work being done was being admirably financed up to a certain limit, it would be advantageous if that limit could be increased. They saw from the report that there were many members of the Institution who were not contributors. The President had made a valuable suggestion that contributors to the Fund should act as ambassadors. Apart from those who were not contributors, there were some 70% of the contributors who did not make use of the Covenant Scheme which, with income tax as it was, was very valuable. It was largely on the Committee of Management that the success of the Fund depended, and he had pleasure in proposing a vote of thanks to the Chairman, the Committee of Management, and the Hon. Secretary for the work they had done during the past year.

Mr. **C. H. Bamber** (Rochdale) seconded the vote.

PURIFICATION AND BY-PRODUCT RECOVERY: A REVIEW*

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THIS paper is an attempt to review the present state of the by-product recovery side of gas production, and to anticipate the trends which may be expected within the next few years. It is written from the point of view of the by-product plant contractor. This branch of the British gas industry can be divided roughly into three sections:

(1) Contracting for gas-works plant of accepted design, either for extension work or for complete new installations.
(2) The investigation of chemical engineering problems which arise out of current methods of manufacture, and modification of accepted designs to obtain higher rates of performance, greater efficiency, or economy in capital and operating costs.
(3) The development of new processes and methods of operation.

The latter two groups of activities have been favoured by the existence of a large number of works on various scales of output, ensuring that the direct trial of improved construction could be obtained by co-operation between contractors and undertakings on any desired scale.

The general conditions of trade and production are at the present time not, it is hoped, to be considered normal, but it is these conditions, and the imminence of the nationalization of the British gas industry, which make the consideration of future trends very speculative. The authors believe that integration of gas undertakings will proceed not necessarily on the lines which have been followed hitherto, but on lines prescribed by the creation of the Area Boards, each with some conditions peculiar to its own territory. In so far as these integrations call for new gas-production installations, it appears probable that larger unit sizes will be customary, and it is suggested that the maximum unit size is at present controlled by the size of the largest single stream that can be purified of H_2S. This may not, in the future, be so definite a limitation.

The unification of gas production into larger single undertakings will, it is expected, have two main consequences. The first is that major changes in practice will involve a greater responsibility, which may be largely met by a more exact application of theoretical data existing or determined beforehand. The second is that it should make possible improvement in the character of the by-products made for sale, a matter which was referred to in the authors' previous paper to this Institution†.

The authors believe that the residuals should come into the chemical market as far as possible as pure products, rather than be marketed as they are at present produced, for what they will bring as partially purified products.

It remains true that the total cost of handling and purification, and the total revenue from the residuals other than coke, is no longer a large factor in determining the total cost of gas, and that quite minor changes of practice in carbonization, or even of distribution, may have a greater financial influence on costs. Nevertheless, failure to market effectively the residuals whose removal cannot be avoided (the tar, ammonia, and H_2S), and, as mentioned, failure to deal properly with the disposal of waste matters, may have consequences apparently of much greater importance than appears at first sight.

The drafting of this paper was carried out at the time that the Gas Bill was issued, and many of the observations herein are necessarily made under the assumption that the present methods of management and administration must persist for a measurable time, that most existing producing units will continue to have requirements in relation to local developments, and that any elimination of existing plants would be done with a judicious regard to the undoubted difficulties in creating new producing capacity.

It cannot, however, be expected that any particular suggestion of a probable line of development may not be fundamentally affected by official policy, any more than it is to be expected that such a development might not be prevented by the introduction of a new technique, the discovery of which has not yet been announced. The authors, therefore, admit that they are quite aware of the possibility that, by the time this paper is presented, responsible persons in the gas industry may be thinking on quite widely different lines.

Standardization

The considerable variety in design effected by the gas industry might lead to the reflection that the professional gas engineer is influenced strongly by a desire for variety. It is not, however, to be concluded that the affection of individual preference in these matters has been, or is now, devoid of usefulness to the development of the industry. In so far as these varieties represent experiment on a working scale, opportunity is continuously offered for the trial of new designs and methods. Uniformity only appears, therefore, in processes which have been thoroughly tried for long intervals, with no important innovation in sight. This, in fact, is the status of the iron oxide purifier.

The number of opportunities for experiment on a working scale is clearly doomed to decline, not only in proportion to the total number of streams being dealt with, but also on account of the increased cost of each experimental effort. It may be agreed that in future fundamental modifications will only be introduced as the result of organized research, which might more properly be considered as technical investigation, the openings for the early application of new discoveries will be fewer, and the discoverer will be proportionately handicapped in proving any points on the technical scale.

In considering present practice and present tendencies in the design of by-product plant in the gas industry, it is first of all necessary to note that any movement in the direction of standardization is limited by the large number of undertakings whose development is normally so slow as not to permit readily of taking advantage of improved techniques.

A second factor unfavourable to standardization is the very wide variation in the size of the units of gas manufacture. It would be generally found that the larger undertakings have a greater proportion of examples of modern equipment than the smaller. This is partly owing to the rate of development of the larger undertakings being proportionately greater. The war years exaggerated this difference, and probably there are very few urban areas which do not exhibit a considerable increase in potential custom.

These increases may appear to arise out of the stringency in supply of coal affecting the home and industry alike, and from the general rise in the standard of living. It is, however, still to be seen how far they are symptomatic of inflation: even that part which is a genuine rise in standard of consumption may suffer decrease by deflation.

Recent Developments

It is generally possible to see certain broad general tendencies in change of method. For example, gas coolers with vertical tubes surrounded by cooling water were commonly supplied at one time, and from a certain date there was a general change over to condensers

* Communication No. 335 of the Institution of Gas Engineers, presented at the Annual Meeting, London, June 8, 1948.
† Observations on the Economics of By-products Recovery in Gas-works. *Trans. Inst. Gas Eng.*, 1939-40, 89, 479.

with short horizontal tubes, modified from the Reutter designs. Recently the tendency has been altered in favour of vertical tube coolers once again, but with a considerable modification in the form, giving increased cooling efficiency per sq. ft. of cooling surface. It is an attraction of the current designs that cleaning and re-tubing costs are reduced.

The Gas Light and Coke Company has recently adopted the type of gas cooler known as the washer cooler in place of tubular coolers for gas streams where naphthalene deposition is normally expected as a complication. In these coolers, contact is effected between cooled gas liquor and the gas on a scrubber filling, the liquor being recirculated through serpentine cooling racks, and the tar separated before re-pumping the liquor. American practice has used this type of cooler for many years past, but not to the entire supersession of the tubular condenser.

The average performance in removal of tar fog from gas has been immeasurably improved by the application of electrostatic precipitation methods, and in spite of the fact that such equipment involves a higher capital cost than for most other types of tar extractors, it is now generally in favour on the score of its moderate power cost and improved performance.

Interesting developments have been shown to follow from the introduction of electrical precipitation of tar on hot gas, particularly in the direction of making possible an improvement in the character of liquor effluents, and the possibility of rendering the recovery of the phenolic impurities in such liquors financially attractive.

Most gas engineers, however, have adopted this process with a view to improving conditions in washing plant and oxide purifiers, and there appears to be evidence that on this score alone this practice has justified itself.

The tower scrubbers of older practice were largely superseded by the rotary mechanical washer, and these again are now generally out of favour, with static washers being given first place.

The history of the gas exhauster can be followed, with at least one major change in the recollection of the average gas engineer, this being in the direction of the use of exhausters running at higher speeds, a practice which is clearly facilitated by employing such designs as have no friction between internal parts. It should also be noted that, in general, the higher-speed machines lend themselves to larger capacity units. It is difficult to divorce the question of by-product plant design from the tendency towards working in larger individual streams.

While the application of recognized principles of chemical engineering has contributed to the increased efficiency and economy of by-product-recovery and purification plant, it must be recognized that circumstances intervene, as very commonly happens in the chemical industry, which may call for wide departures from ideal design. These circumstances include mainly the occurrence of dirt and scale of various kinds, preventing the most effective use of the equipment employed, and, secondly, the tendency to corrosion which occurs where large quantities of impure distillates containing water are being handled. The presence of sulphur in various compounds is a major contributory factor to corrosion.

The dirt and scale deposits of various kinds, including, as they do, insoluble portions of the tar, naphthalene separating from the gas at comparatively low temperatures, corrosion products and impurities in the industrial water employed, have continued to affect the ultimate design of the recovery plant, and up to the present have been a chief cause of the variety of designs being offered.

Size of Plant Units

The gas industry, as previously noted, is progressively moving in the direction of larger units of gas manufacture and purification. The limit of unit size has been hitherto dictated by the oxide purification plant, as the collection of labour for handling oxide from large single units proves inconvenient. There is no particular limit to the individual sizes of other pieces of by-product equipment. Improved mechanization of purifiers will conveniently permit, at the present time, of unit streams up to 12 to 14 million cu.ft. per day, but at the moment there is probably no single stream undergoing dry purification with undivided flow in excess of 10 million cu.ft.

Results of Integration

The integrations of gas-producing undertakings that have occurred so far do not amount to regionalization on the scale of that suggested in the Gas Bill, except in the case of the London area. Such integrations as have taken place have contributed to the tendency in the direction of larger units, particularly where they have necessitated complete reconstruction of the central plants. Current rates of production of steel and manufactured goods have delayed the realization of many of these schemes. The existing integrations represented by the large holding companies were not necessarily designed for development on the lines indicated in the Heyworth Report and in the Gas Bill. Integrations have not usually incorporated municipal gas undertakings, particularly those already established on a large scale.

Certain Government-sponsored schemes previously mentioned, based on gas production at coke ovens, are proceeding, and these have in view the furnishing of fuel supplies for industrial areas not necessarily coincident with the heavily populated areas wherein large gas undertakings already exist.

In the absence of co-ordination of development, it is possible that, particularly in heavily populated areas, many of the schemes of expansion at present projected are in reality overlapping, and that where one succeeds in obtaining sanction and materials for construction it would be possible to defer the corresponding expansion by another neighbouring undertaking. Nevertheless, given adequate coal supplies, the gas industry is in a position to realize a considerable increase in expansion of the gas sales, far beyond that projected in the Heyworth Report. This movement was given a strong fillip by the fact that when coal was most difficult to obtain a year ago, gas supply, and, to a less extent, electricity supply, remained generally on tap, and appliances on sale.

If the nationalization of the gas industry goes through, with the regions set out on the lines of the Gas Bill, it may be expected that some individual schemes of expansion now under consideration will be deferred, if not dropped altogether, in favour of even more centralized manufacturing units.

Seeing that centralized gas production involves also centralized coke production while present methods of gas production persist, it appears likely that more and more coke will be gasified, to ease the problem of its re-dispersal. Thus an ideal of one school of gas engineers will come nearer realization. The methods for ultimate gasification of coal are still rather varied, and it is not likely that these will be able, for some time, to indicate a general trend. It is hardly within the terms of reference of this paper to discuss the possibilities of the production of gas by the direct hydrogenation of coal, or by the synthesis of methane or other hydrocarbons, and we have to content ourselves with the somewhat obvious reflection that the problems of purification and/or by-product recovery will probably be widely different from those we at present have to consider.

These increasingly larger gas-production units will involve changes in practice with regard to the preparation and purification of gas, and it is not likely that traditional methods of, for example, oxide purification will always be adopted. Furthermore, certain synthetic gases, involving as they will do the use of raw materials already highly purified, may not call for the same complexity in after-treatment. The parallel between this state of affairs and the erection of super power stations is obvious. It is the policy of putting the eggs into larger but fewer baskets.

It will not escape notice that with the total number of gas undertakings in the country reduced to, say, 200, the opportunities for individual developments of methods of handling the purification of gas will gradually decrease. This is more obviously the case if the number of gas streams per undertaking is reduced by the installation of larger units. Further progress will, therefore, depend more on the requirements and the observations of the purchaser than on the proposals of the outside technician—*i.e.*, the contractor.

Ammonia Removal

With regard to by-product recovery, for large base-load gas-producing units, the recovery of the ammonia by semi-direct methods is likely to prove the most economical in labour cost. The manufacture of concentrated ammonia liquor should be considered chiefly as a means of centralizing ammonia production economically, whereas the large base-load carbonizing units will probably be able to recover ammonia with sufficiently attractive margins without any intermediate process.

At the time of writing, it would appear that by-product ammonia recovered as concentrated liquor has the effect of releasing synthetic sulphate of ammonia for export. The gas industry is also a producer of sulphur, though not necessarily of sulphuric acid, but it is obviously not making the best return out of its by-product sulphur. Apart, however, from these considerations, there does not appear to be any reason why it should not make its direct contribution to the fertilizer market where the scale of production justifies it.

Two problems will confront large centralized units, particularly if, as expected, they cannot be conveniently placed always at the centre of gravity of a dense industrial area. The preferred location for such a works may be in an area not possessed of adequate existing water supply, or of means for effluent disposal, so that these requirements must be assured where facilities exist, or must be created where

they do not. It will probably be found that the disposal of effluent will be the greater problem of the two. Even where a works on this scale is placed near the shores of an estuary, the running of large quantities of toxic effluent into tidal water is likely to be prohibited, or discouraged, at any rate after preventive or curative means are indicated whereby such effluents can be treated satisfactorily.

Minor Effluents

Much attention has been given to the ammonia liquor, one great source of pollution of water resulting from gas manufacture, but in the course of a discussion on a recent paper,* it was pointed out that there are a number of minor effluents which have to be taken into consideration, and which would become important were a large works to be placed on a new site without the advantage of existing water-purification facilities.

These would include the following:

(1) Surface water, which may collect washings from oxide, coal and coke storage, and oil spillage.
(2) Effluents of the domestic type from lavatories, canteens, &c.
(3) Surplus water and purgings from coke-quenching systems, if any.
(4) Condensate from water gas, particularly from carburetted water gas.
(5) Aqueous distillate from crude benzole plants. This material is not quite innocuous even when obtained from purified gas. It is suitable for use in ammonia washers, and under average circumstances is of about the right volume for ammonia removal.
(6) Water washings and condensates from benzole refining. This is probably a process which would be best carried out elsewhere if the site were a difficult one. Considerable alleviation might be obtained if coals carbonized were of low sulphur content.
(7) Any purgings from liquid purification processes. It is rather difficult to suggest at this stage what conditions might arise. The total amount of toxic matter might, from certain processes, be considerable.

Certain of these might be dealt with by evaporation, producing a condensate of less harmful character, and possibly the availability of the domestic sewage would assist in dealing with a measurable proportion of the remainder. A comprehensive treatment of the whole of these effluents, however, on these lines, would appear to be a rather difficult undertaking.

It is possible, also in the future, that the large amounts of flue gases evolved from carbonizing plants will have to be purified before discharge into the atmosphere, as has been done on power stations in the centre of London.

Oxide Purification

The potential production of sulphur by processes of gas purification appears to be something a little short of 100,000 tons annually. Only a small proportion of this sulphur is put on the market, in a form other than the spent oxide itself. In the meantime, Britain is importing comparatively pure sulphur in comparable amounts, for which we are paying in hard currency. When discussing similar matters in their paper the authors suggested that the gas industry should not limit itself to the production of residuals which could not very well be avoided. Means exist whereby the sulphur in spent oxide can, at a reasonable cost, be brought into a better marketable form, and the authors therefore suggest that, seeing that spent oxide is at present selling in a somewhat depressed market, there is every inducement to develop these extraction processes, or alternatively, to effect purification by means which will more readily produce a sulphur which has a possibility of entering a better market.

Up to a few years ago, the purification of gas from H_2S by means of iron oxide was accepted practically without question as the established and almost inevitable means of treatment. This position held good in spite of the widespread application of liquid-purification methods on the large scale in the United States of America and in Germany. This general acceptance is, therefore, being challenged by reason of the present reduced supply of labour and of constructional materials.

It is becoming commonly accepted that the time has come for reconsideration of methods of purification from H_2S. The overall cost of purifier boxes on the large scale, the area occupied, and the man-power involved, point in this direction. So also does to some extent the continual supervision required to keep a given mass of oxide in a satisfactorily active condition, to bring it out in a saleable condition, and, which has been commonly not very successful in the past, to attempt to avoid its hardening when in the later stages of its life.

Certain large works, by maintaining a large number of individual streams, can employ a moderate labour gang practically continuously over the greater part of the year, whereas the smaller works, with only one or two streams of purifying boxes, must mobilize a disproportionate labour force at irregular intervals. To some extent these difficulties in oxide purification can be met by changing the form of the containers and by mechanizing the loading and unloading of the oxide, to the maximum degree. The large capital sums invested in purifier boxes of the standard pattern naturally preclude, in our present economy, immediate change-over to new methods, however desirable that might otherwise appear.

The liquid-purification installations of the United States of America are not normally called on to obtain purification to the statutory standards, and, although purification by liquid means has reached this standard in at least one very conspicuous case, it is worthy of note that these successes do not appear to have been repeated elsewhere, in spite of the encouragement given by these examples.

While the authors fully believe that the oxide purification process remains capable of development in the direction of greater convenience and economy, they are also strongly of the opinion that any liquid purification process which is sound from the point of view of chemical engineering could be made fully effective if it could have only a fraction of the number of years of experience that have been afforded to the conventional oxide purification cycle.

The most serious deterrent at present is obviously the risk of breakdown, however temporary, and the practical impossibility of meeting such a risk except by the most thoroughgoing duplication of the plant and means of power supply. It is most important to be assured that in a process necessarily of some complexity such safeguards can be applied to give an ultimate margin of safety which is, for example, equal to that obtained by supplying duplicate exhausters. The ultimate effect of breakdown of exhausting plant is the stoppage of gas manufacture, and this remains as a most remote possibility. A comparable margin of safety on a liquid-purification plant has to be visualized, and more particularly if the desire to operate in large units, which might only be single streams for any given works, is to be provided for. A particularly large manufacturing station handling four or five streams of gas would be better able to take such a risk, and, during the time which must necessarily elapse in order that adequate experience of liquid purification may be gained, there would still be the possibility of falling back on oxide purification plants still remaining.

This stage appears already to have been passed on the coke oven plant of the Société Carbochimique at Tertre, where all oxide boxes have been removed from the site. It is necessary to observe that on this works there is now available many years' experience of the States Mines-Otto process.

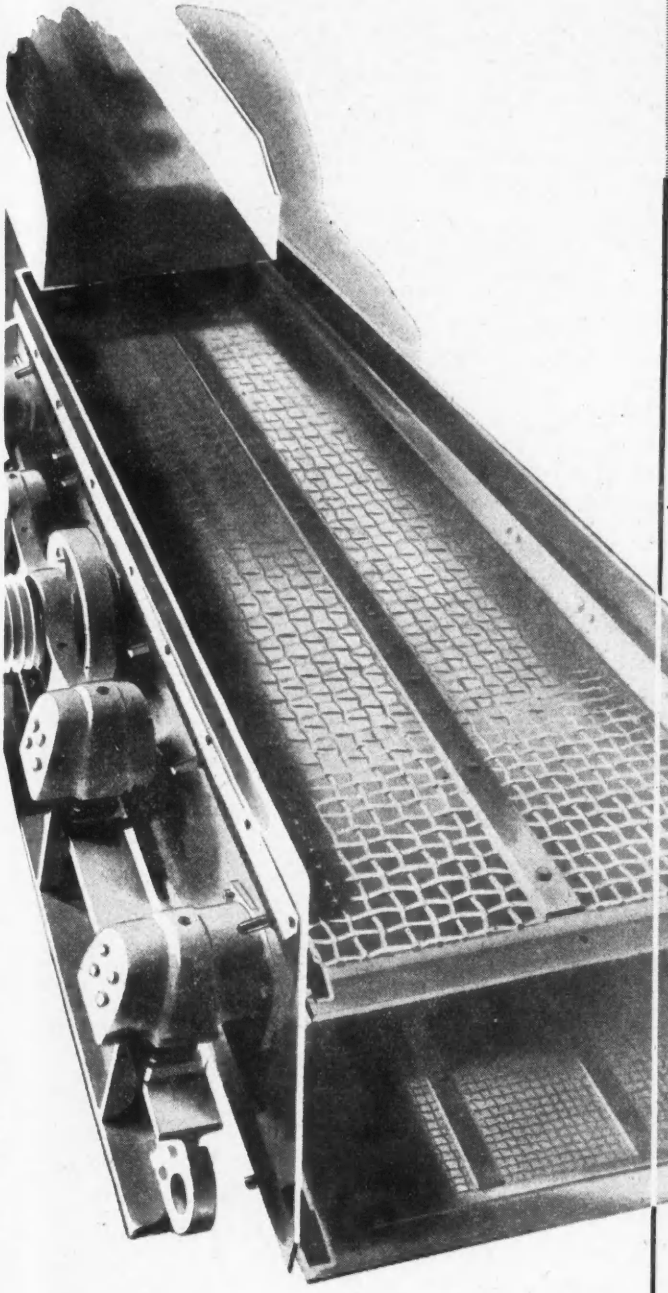
Probably the most ambitious attempt to carry out purification by a liquid medium in this country is that of the Manchester Corporation Gas Department, known as the Manchester process. The present scale of operation is 2 to 3 million cu.ft. daily, and it is definitely one of the claims of the process to have effected purification to the Gas Referees' standard, whereas this is not usually attempted on liquid-purification processes. Work is still continuing to establish conditions for satisfactory continuity of operation, and these developments are being watched with much interest. It may be expected that full publication of the results will be made in the near future. Apart from the original working-scale plant constructed for the patentees, four other installations are in the early stages of construction, and it is hoped that these will give data over a variety of conditions, one, for example, being for carburetted water gas.

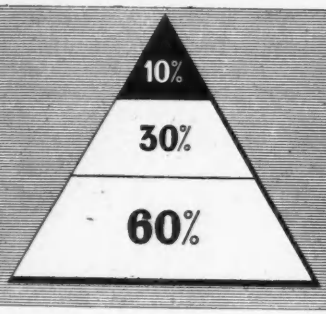
In the meantime, and pending the maturing of this or some similar far-reaching change, it is possible, as in the case of the tower-type purifiers originally constructed by Thyssen, to minimize the total quantity of constructional materials required, and the irregular calls for labour which oxide purification otherwise demands. In other cases, purifier boxes of steel plate, sometimes containing great depths of oxide, have been applied as a solution. It should, however, be noted that changing the form of the purifier box does not in itself afford means of reducing the labour force or the total labour costs.

There is at the present time taking place a considerable development in the direction of the use of tower purifiers, based on the Thyssen-Lenze patents and widely employed in Germany on coke oven and gas plants contributing gas to the Ruhr grid. This system has been described already in Colonel C. M. Croft's paper to this Institution,* and it will suffice to point out at the moment that the

* Treatment of Gas-works Effluent, with Special Reference to a Gas-works Making 14 million cu.ft. of gas per day with Intermittent Vertical Chambers. Nicklin, T., *Gas*, 1948, 2 (18). 372 to 384, and (19), 402 to 415. Man. Jun. Gas Assoc.

* *Trans. Inst. Gas Eng.*, 1938-39, 88, 1291.





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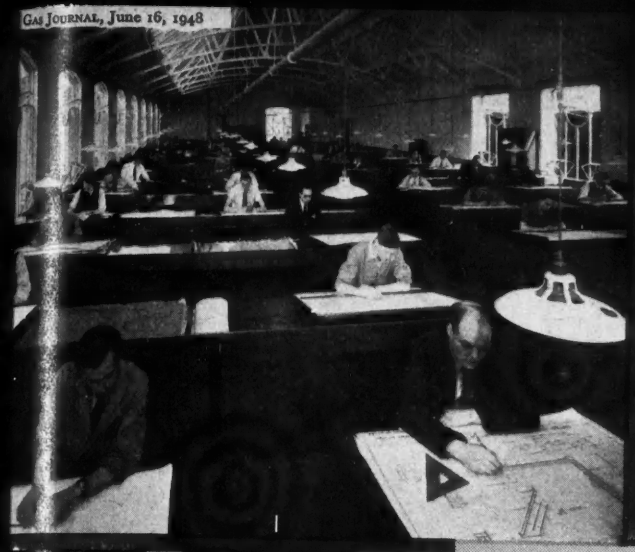

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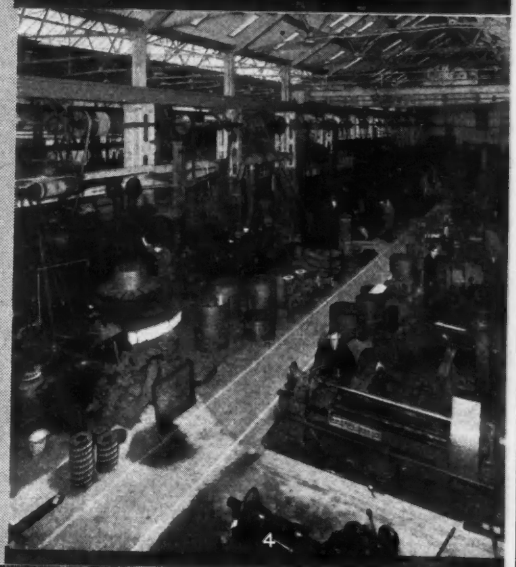

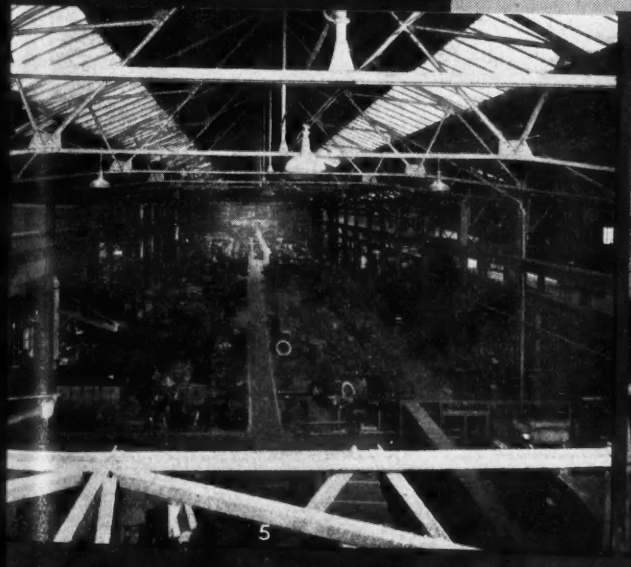

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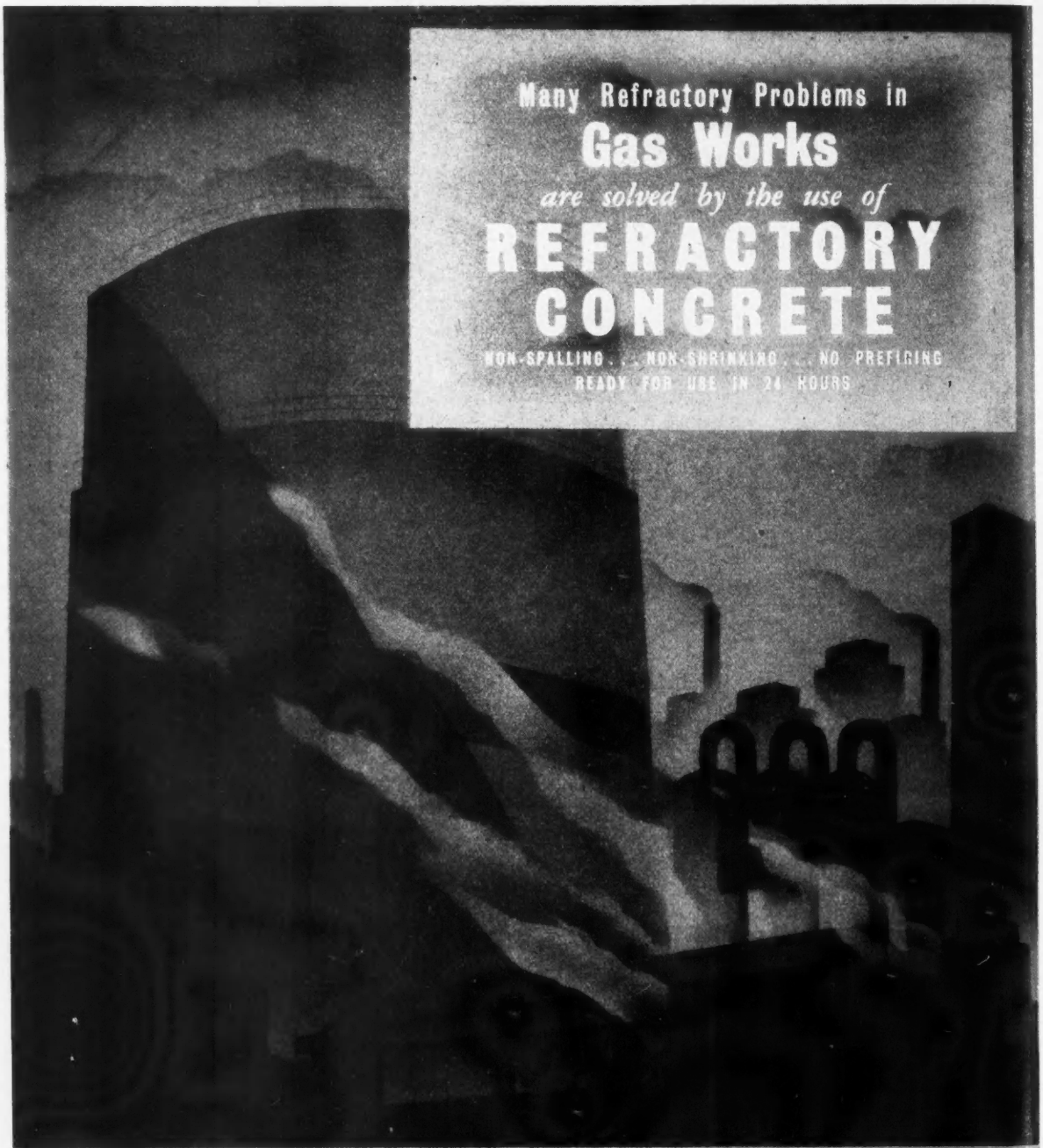
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essential feature is that the oxide is handled in quantities of 30 to 50 tons per parcel when filling and discharging the purifier boxes, as it is carried in steel containers each of which partakes of the character of a separate purifier box. In order to do this, an overhead crane is employed which is capable of dealing with several hundred tons of oxide in a few hours, so that by having an adequate quantity of fresh containers available, no purifier box needs to be out of action for more than, say, one shift. The total labour requirement is limited by the fact that the discharged oxide is removed from the containers, and replaced by new, by a small group of men working practically continuously throughout the year, and not by a large gang brought in for the purpose.

A certain advantage, also, is usually found in the total ground space occupied for purifying large quantities of gas.

High-Pressure Treatments

On the other hand, a stimulus may be given to the development of alternative methods of purification by the obvious desirability of carrying out as much of the cleaning of the gas as possible under pressure, particularly where the gas is ultimately to be despatched under pressure, which will frequently be the case with large central gas-producing units. In such a case there is no extra cost involved in compressing the gas while crude, other than a possibly greater volume coming into the compressors. There would presumably be special provisions against corrosion when handling unpurified gases.

Liquid-purification processes, however, are easily adapted to high-pressure work, and so are certain systems of continuous oxide purification which have been applied to synthesis gases. The ordinary static iron oxide bed is not so easily adapted for high-pressure work, and it requires a complete re-design of purifier box, a design based on the pressure involved rather than on convenience and accessibility.

It would appear, however, that seeing that oxide chambers are capable of absorbing only a limited weight of sulphur per unit weight of mass, whereas the gas, being under pressure of possibly many atmospheres, is capable of bringing in large weights of H_2S, there is not a great advantage in using oxide under high pressure as the changes of oxide mass must be very rapid, particularly if the exigencies of construction for pressure require the total volume of oxide per chamber to be relatively low, so that the fabric can be more safely and easily manufactured for high pressure. It might be mentioned that the Thyssen-Lenze system of vertical tower chambers for purifying the gas has, in fact, been used for purification under high pressure in certain works on the continent.

While discussing the problem of handling gases under pressure, it should not be overlooked that benzole recovery, organic sulphur removal, and dehydration are very much facilitated by handling the gas under pressure. One coking installation is already extracting benzole and sulphur compounds under pressure. It will also be noted that preliminary compression is a stage towards liquefaction.

Investigations have been reported on dealing with the fundamental chemistry of the purification process, and the Gas Research Board has formed a panel of investigators to inquire into, among other problems, the causes of the hardening of oxide in use, a phenomenon which is capable of rendering expensive and inconvenient the removal of used oxide from purifier boxes. No report has been issued at the time of writing.

Water Supply

The most important water requirements of gas-producing units are for the cooling of the gas, and it will be seldom that natural and local supplies are available in satisfactory quantity and quality. The remedy is the same as has been applied to electric power stations, to re-cool all used water on the site, and to control and retain its quality. Seeing that quantities of water are also required for steam raising, and that high-capacity boilers demand pure water, this becomes of still greater importance.

A question which is at present engaging a panel of the Gas Research Board is that of obtaining a long life for steel tubes employed in gas cooling, and at the moment the position is not very satisfactory. The solution will probably depend on the combination of a satisfactory water supply and the co-operation of tube manufacturers to produce a corrosion-resisting tube at an economical price.

Materials of Construction

In common with most other industries the gas industry has progressively employed more and more fabricated welded equipment, with a corresponding exclusion of cast iron. The loss of man-power in the foundry industry has probably been the greatest single contributory factor, but it is necessary to consider how far the preference for cast iron has been due to a tendency to build plant as permanently as possible and to ensure resistance against corrosion. The life of the by-product plant on a single stream of gas is not necessarily required to exceed that of the gas-making plant.

The relative incidence of capital costs, being progressively lower on the larger scale of gas manufacture, should encourage the scrapping of both the carbonizing and gas-handling plant after a reasonable term of obsolescence, and the choice of the original equipment should depend more on its economic performance than on its original cost or inherent durability. These considerations would not preclude the use of other material than steel plate and cast iron, where there might be advantages of immediate availability and specially attractive properties. Protective coatings, non-ferrous metals, and a wide range of plastics, are coming into use for the benefit of their special properties, and the inducement to use them is reinforced by the increasing difficulties of obtaining construction in the more conventional materials.

It cannot, however, be recorded that the use of reinforced concrete has made much advance recently, even in the direction of the construction of the bodies of purifier boxes. A recent study of the use of alternative materials for a particular job revealed that when the reinforcement steel was taken into account, the overall saving of steel was a comparatively minor consideration.

It should not be overlooked that certain components in a fabricated plant may have a much shorter life than that of the main fabric. Cases are the tubes of condensers and the grids of purifiers. The calculation of costs over the total life of the stream would therefore have to take account of the varying sets of circumstances.

The failure of certain components in fabricated steel work, particularly gas connexions, has been attributed to corrosion under stress. Certain results have been published indicating that such local corrosion can be eliminated by stress relieving, an experience which corresponds with findings in other fields of work.

Recovery Processes

As processes which are not essential to gas production on any particular works, we have to consider the recovery of ammonia for sale, with its related problem the disposal of effluent, the allied processes of benzole recovery and naphthalene removal, along with a third possibility, the removal of organic sulphur compounds, and the removal of water vapour from the gas before distribution.

The war at the same time stimulated the production of some of the plants involved, and discouraged others. Otherwise it might have been found that there would have been a greater tendency to uniformity in practice in each of these departments. Post-war conditions of shortages have, in general, been discouraging, and in particular the greater refinement of purification represented by the removal of sulphur compounds has made little progress recently. Gas dehydration has, however, shown signs of revival.

Ammonia Recovery

It is not difficult to state reasons why the recovery of ammonia as sulphate or as crude concentrated liquor, or, in fact, in any marketable form, has not been adopted as standard practice. For any particular stream of gas, the potential annual turnover is small, and the revenues are only too easily absorbed in capital, labour, steam costs and maintenance. The fact that the daily production is not uniform is also reflected in the balance sheet. Seeing that the distillation of ammonia liquor does not in itself offer a ready solution of the difficulty of disposing of crude liquor, and that, in fact, stripped liquor may be in itself almost as great an inconvenience as the crude liquor, the inducement to persevere with the recovery of ammonia is not strong. The bringing together of various makes of ammonia into centralized ammonia factories, so often advocated in the past, is therefore a transaction of minor commercial interest only, and considering the matter all round it would require some new inducement to reinstate ammonia manufacture as a regular operation on gas-works. Such an inducement might be a penalty on pollution of water-courses, where effective public treatment installations were not available, or where the cost of providing such treatment might be prohibitive.

The disposal of distilled ammonia liquor with or without the addition of lime, is a specialized problem in trade effluent treatment. Its peculiarity is that the more important toxic matters dissolved therein have a reasonable commercial value, but that, except on the large scale, their recovery may not be expected to repay the cost of extraction. The solution would therefore appear to be the systematic development of treatment plants where ammonia liquor is being collected from all minor gas undertakings, coupled with a serious attempt on the part of the major undertakings to deal with their effluents themselves. The dispersion over the country of the discharge problem is convenient in that high concentrations may be avoided at

any one place, whereas the concentration of manufacture makes purification more feasible commercially. Arising out of these circumstances, any new carbonization plant being placed for convenience near a coal-producing area would not necessarily find it feasible to go into gas production without careful consideration of the disposal of its effluent.

Irrespective of the actual cost of treatment, it is probable that more severe limits of toxicity may be imposed, corresponding to those which have been insisted on for many years in exit gases from sulphuric acid plants and other chemical factories. It is, moreover, not to be assumed that undertakings placed on or near the sea coast will retain liberty of action in this respect. The whole question, of course, needs to be considered in conjunction with the treatment of other forms of trade effluents and of domestic sewage. The cost and materials for constructing installations will naturally be a difficulty for many years to come.

APPENDIX—QUANTITIES AND VALUES OF CERTAIN IMPORTS AND EXPORTS

	1940	1941	1942	1943	1944	1945	1946	1947
EXPORTS								
Ammonium sulphate—								
Tons	166,291	10,213	39,174	6,149	133,063	252,327	277,925	246,280
£	1,495,517	115,742	420,206	67,551	1,525,595	3,072,454	3,804,719	3,903,776
Benzole—								
Gal.	160,502	115	2,398,100	31,603 206	44,859,535	30,600,900	1,207,936	577,552
£	15,792	42	259,015	3,369,613	4,802,226	3,287,253	178,670	91,619
Naphthalene—								
Cwt.	56,358	62,095	29,377	109,402	54,240	50,042	55,078	21,079
£	58,798	80,557	48,043	229,275	115,944	101,356	132,775	65,303
Creosote Oil—								
Cwt.	2,528,289	260,909	342,594	44,469	32,663	51,006	478,937	3,226,134
£	674,018	98,563	115,690	36,342	21,391	31,169	237,647	1,660,517
Tar oil, anthracene oil and heavy coal tar oils, &c.—								
Cwt.	75,680	112,111	93,611	40,146	68,993	90,540	89,131	108,700
£	39,078	63,791	46,785	50,546	119,594	127,640	133,126	177,061
IMPORTS								
Sulphur—Total imports from all countries—								
Tons	217,117	293,609	124,993	268,874	197,231	198,165	246,460	305,475
Per cent from U.S.A.	90	100	100	100	95	100	100	100
£	1,539,252	2,292,795	1,016,925	2,190,297	1,591,908	1,667,955	1,842,218	2,448,771

Benzole Recovery

The necessity of having adequate supplies of liquid fuel will, sooner or later, it may be assumed, lead to the general resumption of benzole recovery, but if the policy in gas-making is to have highly extended makes, it may be debatable whether, until coal supplies and carbonizing capacity are more freely available, it will not pay to continue to enrich diluent gases by leaving benzole in coal gas. It must be expected that investigations will continue to find means to recover, from rich coal gas, products more volatile than benzole which are in demand in chemical markets for purposes other than fuel. The processes that will recover volatile substances (*e.g.*, liquefaction), will also presumably remove the more important organic sulphur compounds without any special equipment for the latter purpose.

It is axiomatic that the inducement to the recovery of benzole from gas depends on the relation between the cost of the coal and the selling price of the gas and coke. There are certain technical difficulties in having a large effective extraction from gas required to be sent out at high calorific values and in the extraction from gases which have been highly diluted by water gas. It is also easy to show that a certain increment in coal requirements results from the removal of each unit of benzole, by whatever process, but a good many of these possible deterrents were removed by the necessity for supplies of liquid hydrocarbons during the war, from which it may be inferred that if the coal and the capacity to carbonize it were made available there would be a good case for revival of benzole production on the maximum scale at the present time, from all existing plants or at the least from all plants above a certain capacity. It is agreed that the total potential production of benzole is not large compared with the nation's idea of its requirements for motor spirit, and that the installation costs probably appear out of scale with those of the petroleum industry for a corresponding output.

The present import and export position of the country will, it is thought, be likely to prescribe that hydrocarbon spirit from our coal should not merely substitute imported petroleum spirit, but might even be a valuable export and continue to be so for some time to come.

[See table above—"Quantities and Values of Certain Imports and Exports."]

Organic Sulphur Removal

It is well known that benzole recovery, as carried out normally, results in a reduction of sulphur compounds, and this effect can be pushed to a higher degree by deliberate design. It should, however, be represented that the first step in reducing the obnoxious organic sulphur compounds in gas should be by improvement in the coal sent to carbonizing stations. The use of coals of low sulphur content would greatly reduce the total cost of purification of the gas, and would minimize corrosion of gas-works plant in every department. The ultimate removal treatment to bring the sulphur in gas down to a tolerated figure of, say, 3 to 5 gr. would be more feasible. There is a strong case for the reserving of washed coals to gas production.

The carrying of the purification of gas down to this low figure will otherwise involve a special treatment, not connected with any financially profitable recovery, in the form of high-temperature hydrogenation or oxidation treatment, usually referred to as catalytic sulphur-removal plant. This development had reached an acceptable form technically about the time of the outbreak of war, but there had been no installations on gas-works, except those arising out of experimental work. Two of these plants built on a working scale have already given several years' continuous and satisfactory performance.* Much experience has also been gained in the industrial field, by the supply of working units of varying capacities, and these units can be supplied in a reasonably cheap and reliable form. The release of adequate supplies of construction materials would now permit of these processes going ahead on the normal gas-works scale. As mentioned above, their existence does not, however, render any less desirable improvements in the raw coal used in the carbonizing industry.

Dehydration

Gas dehydration has for its object the short-term advantage of avoidance of condensation of water in gas-distributing systems, and of the stoppages resulting thereby; and the long-term advantage of the reduction or prevention of corrosion in the distribution system and damage to consumers' meters.

It must be noted that the practice of gas dehydration, widespread as it is, is not necessarily established in neighbouring undertakings. Consequently, where linking up is effected, the effect is largely lost where the gases mix. It is worthy of note that with very few exceptions, most of the undertakings which have once instituted gas dehydration have now carried through the practice for 15 years and upwards, and it may be assumed that in most cases the desirability of its continuance would be great. The methods at present used will probably continue after integration to a great extent. After a period of years, it is very likely that more and more gas will be received through high-pressure lines, and will be at the point of consumption already partially dehydrated by the compression effect, followed by release to low pressure. Consequently, most low-pressure networks so supplied will be water-free. The advantage of deliberate dehydration will then be more and more limited to the major transmission lines, where it will be beneficial to reduce the moisture content of the gas immediately after compression. The degree of dehydration required in this climate, in order to prevent subsequent water deposition, is seldom greater than 50%, a figure which is possible either by absorption or refrigeration methods. In short, most low-pressure gas networks will ultimately be water-free, and it will be an advantage to bring high-pressure lines into the same condition.

The importance of dehydration of the gas before distribution is enhanced in cases where gas is sent out with considerable dilution either by air or carbon dioxide, a state of affairs which may arise if gas is sent out from complete or nearly complete gasification processes and the diluting gas is of the class of producer gas or water gas.

Conclusion

It has not been possible within the limits of such a paper to draw up an exhaustive review of coal by-product plant, particularly in regard

* At the Harrow Station of the Gas Light and Coke Company, London (capacity 100,000 cu.ft. per hour), and the Mirfield Gas Company (capacity 30,000 cu.ft. per hour).

to quantitative aspects. The authors have had to confine their remarks to features which appear to them to be of significance in relation to trends they believe are occurring, and to attempting to form conclusions as to the direction of future development. Profound changes in the structure of the British gas industry are now impending, and anything approaching certainty is impossible in regard to many of these conclusions. It is, however, clear that many of the changes, particularly as they affect practice, will be slow, simply because of the difficulty of obtaining materials for the replacement of existing plants, and for the construction of new plants on whatever may be the determined lines. The authors feel that members of the Institution of Gas Engineers will have their own grounds for forming conclusions which may differ very widely from these, and hope they will take the opportunity of expressing them in the discussion of this paper.

DISCUSSION

Dr. **H. Hollings** (Gas Light and Coke Company): My first impression on reading this review of the present state of gas purification is that the authors are unduly apprehensive as to the opportunities which will occur in future for the early application of new discoveries. I agree with them that in future fundamental modifications in plant design and operation will be introduced only as a result of organized research or, as they put it, as a result of the more exact application of theoretical data determined beforehand, but I do not share the fears which they appear to have that there will be fewer opportunities for practical trials on a technical scale. Perhaps this is because I do not visualize a concentration into units quite so large as the 12 to 14 mill. cu.ft. per day units mentioned. Although in my Company we have had experience of one such large unit on the coke oven plant at Beckton, it is perhaps significant that in the case of the new ovens now under erection, the size of unit is limited to 7½ mill. cu.ft. per day and I believe that for gas-works, as distinct from coke oven practice, it will be found that a 5 mill. cu.ft. per day unit will be large enough. If this view is accepted, there will be plenty of opportunities for the logical development of plant design and operation which I know that the authors desire.

Reference is made to the present practice of my Company in favour of vertical tube condensers in place of horizontal coolers and also in favour of washer coolers in place of tubular coolers of either vertical or horizontal design. These developments have taken place in an attempt to eliminate some of the corrosion difficulties and at the same time to find a more elegant method of dealing with naphthalene deposits. I will merely observe that this particular subject, as Mr. Cooper said, was dealt with in detail in a paper presented to the Southern Association of Gas Engineers and Managers last month.

I share the authors' view that we are not securing the best possible return for our by-product sulphur. As most of you know, this is a question which has been taken up by the Gas Research Board and about which I hope we may hear more at the November meeting of the Institution. I suggest that this is a field in which the accountants might help us. There has never appeared to me to be any reason, other than tradition, why in the accounts of gas undertakings sulphur should be dealt with so differently from ammonia, and perhaps when the new Area Boards come to settle the form of their accounts, a little further thought can be given to this detail.

The Problem of Effluents

I am very pleased to see that the paper deals so frankly with the problem of gas-works effluents. The researches with which Dr. Monkhouse was associated indicated that in certain circumstances the effluent from the ammonia still could be improved by installing an electrostatic precipitator on the hot gas so as to prevent the solution of higher tar acids in the ammoniacal liquor. A still further improvement could be secured if the phenol could be extracted by one or other of the known methods. Perhaps it has not been sufficiently widely recognized that it has not been found practicable by the industry to carry out the recommended treatment of the hot gas. The process is practicable only when dealing with gas from continuous vertical retorts whose tar is sufficiently fluid to flow away from the precipitator. There is a further limitation when carbonizing Durham coal in continuous vertical retorts because in these circumstances condensation after electrical precipitation would involve difficulties due to naphthalene because of the prior removal of some of the solvent tar in the precipitator. As will become clear from a study of the paper by Pexton, Dougill and Ravald, to which I have just referred, when carbonizing Durham coal, and particularly when carbonizing it in static plant, it is necessary to install the electrostatic precipitator after the primary condensers.

It then remains necessary to emphasize that in modern gas-works practice great care should be taken to admit the air necessary for gas purification in such a way as to avoid the formation of thiocyanate and thiosulphate which cannot be removed from the effluent by any process which is actually in industrial use, although great ingenuity has been exercised in directing laboratory research to that end.

I want to say a word now about the liquid purification of gas for the removal of hydrogen sulphide. My experience in studying a number of these processes over a period of years has been that there is usually either what is called by the authors a purging, or a spillage, containing these very undesirable oxidation products of whatever reagent is used. On a large plant this may constitute an effluent disposal problem of no small magnitude.

Finally, I refer to the section of the paper dealing with dehydration and want to call attention to what I regard as a most surprising omission from a paper of this kind. There is no reference to the possible occurrence in gas of nitrogenous gum and of the steps which may be taken to prevent its occurrence in distributed gas.

I never want to see again a scare such as we had some 13 years ago when this substance was first noticed in our gas, but at the same time it would be most unfortunate, in my view, if in a broad review of purification technique such as this we should overlook certain precautions which should be taken in the light of present knowledge if trouble is to be avoided. The broad conclusions of the paper which I presented on this subject to the Institution in November, 1936, still hold good. Gas should either be stored wet or it should first be treated by some process for the removal of nitric oxide.

Catalytic Process at Harrow

Two processes have been in use by my Company for some years. One is the catalytic process at the Harrow works. Let it not be forgotten that that process was developed in the first place just as much for the removal of nitric oxide as for the removal of organic sulphur, which always attracts more popular attention.

The other process is a gum reaction tower which has been in operation at Kensal Green since the late summer of 1939. This does not appear to have been described, except in the patent literature because of other preoccupations during the war years. Actually, about 20,000 mill. cu.ft. of gas have been treated by passing the gas through a reaction vessel of such a size that the nitric oxide reacts with the conjugated diolefines and the oxygen before the gas reaches the outlet pipe. The important feature is that a reaction time of about three minutes should be allowed during which there is minimum contact of the gas with any surface which would inhibit the reaction. Since this vessel was brought into operation there has been the virtual disappearance of troubles due to gum on the works governors and gas pumping plant, while complaints from the district are now almost unknown.

The authors have rendered a great service to the industry by developing the gas dehydration process. They will do still more service if they see to it that either the dehydration process is installed after the storage plant or, where this is not possible, that some process for the removal of nitric oxide from the gas is installed.

Mr. **A. G. Grant** (Whessoe, Ltd.): The authors' survey, which is admirably concise, codifies what is known in a way which perhaps is not known, and deals with observable trends while resisting the temptation to speculate about the remote future. It is difficult to criticize, but in reading it one is led to make a number of philosophical reflections.

The first is how right were the gas engineers of the last century, and how long has it taken us in this country to improve on their work! They had little scientific method at their disposal, but they were first-class engineers in the all-round sense, and they built plant which often did them more credit than some plant has done to builders in recent times. To give two examples, they built vertical tube condensers which were not, by present-day scientific standards, efficient, but they worked extremely well with the minimum of trouble.

Fine Piece of Chemical Engineering

About 20 years ago the industry began to go all scientific, and looked at heat transfer coefficients and arrived at the horizontal tube Reutter condensers. That is a fine piece of chemical engineering, but the engineers who have to clean that piece of chemical engineering by taking covers off the tubes are not very pleased with in. I feel that in coming back to the vertical tube condenser, designed in line with modern scientific knowledge, the industry to-day have provided something which is both workmanlike and sound. Similarly, the industry have progressed from tower scrubbers via rotary washer scrubbers back to tower scrubbers in the form of static washers.

I often wonder whether the first generation of scientific approach completely failed to inherit the practical sense which its less scientific parent had.

My second reflection is a broader one—how long it is taking to improve on both the chemistry and the practice of H_2S removal. I cannot help thinking with a little jealousy and envy of the first purification, done a hundred or more years ago, with lime, which took out H_2S, CS_2 and CO_2 in one operation, and on the whole very satisfactorily. So far they have gone only part of the way to

solve the organic sulphur problem, and they are not completely satisfied with the method of H_2S removal, which was evolved 80 years ago and is still the best means of doing it.

In this connexion I am glad that the authors record that active work is in hand on various aspects of H_2S removal. For the benefit of the outside world of chemical engineers, who occasionally look at the processes of the gas industry, it might be desirable to give a warning that oxide purification might look cumbersome, but it is very cheap, and the driving force in a financial sense towards an alternative process is not very great. I have friends who are chemical engineers outside the gas industry, and they take an all too simple view of the gas industry's H_2S removal problem.

Field for Plant Designers

A third reflection is what a marvellous field the gas industry affords for those who are interested in the design of plant for it. Even with the number of works reduced, as the authors suggest, to 200, there will still be many thousands of examples of any one unit of plant, a unit condenser or a unit scrubber, or whatever it may be. That gives an opportunity which is present in few industries for development to take place. Instead of any one new design of plant having a potential field of tens and a repetition time of a number of years, in the gas industry a new plant may be installed in hundreds, or even in thousands, and in considerable numbers every year. People in other industries, and particularly the chemical industry, look with great envy at the repetitive field afforded by the gas industry for trying out ideas.

Fourthly, the appetite of the designer is whetted by the authors' reference to purification in the future at high pressures. When allowable pressure drops can be measured in pounds rather than inches, transfer coefficients will begin to assume really exciting values.

My fifth reflection is a sobering one that after the brilliant inventiveness of the early days of the gas industry, the industry went through an all too long period of empiricism and copying; they advance by novelty rather than by sound inquiry and scientific design. I think that it is fair to say that only in the last 20 years have advances been made on a true scientific basis. In this connexion, the recent paper giving a description of the study made by engineers of the Gas Light and Coke Company of the problems which they faced at Beckton and the way they solved them is an example to everyone of how development should proceed.

I should like to make one criticism of the present paper. The authors have not allowed themselves to record the conclusion to which their observations led. They should be proud of the fact that they are handing over to the nation an industry which on the purification side is full of life and health. Not all their plant is modern in age or in style, but much plant in existence and being built is in line with the best scientific thought. What is much more important, both contractors and gas undertakings are showing a lively interest in improved design and great engineering aptitude. There is in being a true competition of technical minds, the reward being in the success of the plant rather than in any form of financial incentive. That is a very great even if an intangible asset to hand over. This happy state of affairs on the side of purification is in no small degree due to the company of which the two authors are members, but, as a fellow contractor, I would like to pay a tribute to the contribution made to the science and practice of gas engineering.

Mr. N. Hudson (Mirfield): I have read this paper with a great deal of interest particularly since the review has been made from a viewpoint which is necessarily different from that taken by a practising gas engineer in charge of town gas manufacture and supply.

The paper gives a factual review of both the existing position and the present tendencies in plant design and operational practice. It also endeavours to correlate existing problems in gas purification and by-product recovery with the anticipated planning and future development of the industry, and in this latter respect one cannot help but draw the conclusions that the authors feel that there are too many variables or uncertainties to allow them to anticipate more than vaguely the changes which are likely to occur in the future.

Future Aspects

There are, however, certain positive aspects of the future which will, I think, in a major degree dictate a policy to the industry. Some will be limited in their influence to specific areas of the country, others will exercise their influence more extensively. Such aspects as the following may be listed as having a positive character: (i) availability of water suitable in quantity and quality, (ii) disposal of effluents, (iii) disposal of by-products, (iv) availability of labour. Under (iii) and (iv) I wish to make a few comments with particular reference to sulphur removal.

The authors review the position of the removal of H_2S from crude town gas and suggest that any liquid purification process which is sound from the point of view of chemical engineering could be made fully effective if it could have only a fraction of the number of years of experience that have been afforded to the conventional oxide purification cycle. With this, most chemical engineers would likely agree; but in reply I would pose this question: Cannot we use certain liquid purification processes in their present state of development as a means of easing our difficulties? It is a fact that if certain undertakings could choose coals of low sulphur content, they could make a material contribution to this difficulty since such coals would allow a bigger volume of gas to be treated with proper control, there would be fewer boxes to empty and less spent oxide for disposal. This solution, however, is not available.

Surely a similar effect could be obtained by using a liquid purification unit for scalping H_2S from crude gas. Such a plant would not be called upon, in such a scheme, to be as reliable as box or tower purifiers, but it would and could in its present stage of development enable the industry to limit the work thrown on existing box installations in just the same way as if they purchased low sulphur coals. Again the availability, as a by-product from such a plant, of free sulphur mixed with small quantities of ferric oxide and dried down to 20% of moisture would be a useful material for topping up low sulphur spent oxide and thereby make it more attractive to the acid manufacturer. This latter point would, of course, only apply if the plant was installed after tar fog removal.

My suggestion is that we shall be compelled by (i) the sulphur content of the coals available for carbonizing, (ii) labour difficulty in connexion with box emptying and filling (iii) difficulties and costs in working up and disposing of spent oxides, and (iv) the high cost of new purifier installations, which in many cases are only working at capacity two to three months each year, to install and use any plant which will ease our difficulties rather than wait for some other plant which will completely replace our present purifiers. It is possible that such a course, giving facilities for trial and experience, may hasten the day when H_2S removal as we know it to-day will be replaced by a new technique.

Unanswered Problems

Mr. J. T. Haynes (Bournemouth): This paper is a review. The authors pose a number of problems but never give an answer. How can one discuss such a paper? As indicated by the President, the authors have had in mind the conditions which may arise from integration of the industry under nationalization but, like the authors of other papers presented at this meeting, they wisely say that they cannot prophesy. Before trying to forecast the developments which will take place under nationalization, I think we must continue to give consideration to current problems with a view to overcoming our present difficulties, because obviously it will be some years before integration on a large scale can become operative.

Many undertakings adjacent to the coast find that it is cheaper to use sea water in both gas condensers and steam condensers, but inevitably they have the problem of incrustration, and much work has still to be done to find a suitable pre-treatment of sea water to avoid this incrustration. Again, whether one uses sea water or town water for gas cooling, a considerable wastage takes place owing to the difficulty of controlling the quantity of water to suit the varying quantities and conditions of the gas stream. This problem is particularly acute where gas condensers are used in parallel, and it is suggested that a practical solution to the problem of thermostatic control would be of distinct advantage to the industry.

As pointed out in the paper, works near the shores of an estuary sometimes find it advantageous to discharge their effluents into the tidal waters, but there is a prospect that they may be prohibited—or at least discouraged—from doing this in the future. What is the present position of detoxification of liquor? Is it technically sound, and what are the economics of such a process?

Under the heading of "Oxide Purification" the authors draw attention to the unsatisfactory position which exists in this country, whereby thousands of tons of spent oxide remain unsaleable because of the difficulty of extracting the sulphur, while the country spend £2½ million a year in purchasing sulphur from America. There is reason to believe that a successful recovery process will soon be available and the interests both of the gas industry itself and the nation as a whole would justify concentration of effort on developing suitable recovery processes. In this field of purification one cannot help but regret that the Burkheiser process which offered such bright prospects a generation ago failed owing to the difficulties of obtaining a satisfactory catalyst and also, I think, to insufficient understanding of the problems resulting from the lack of balance between the ammonia and the sulphur in the gas.

One would also ask if the gas industry is too apathetic towards the removal of organic sulphur. A number of plants have been in operation for some years, but in spite of the fact that the whole industry seems to be convinced that sulphur-free gas is desirable very few undertakings appear as yet to be satisfied with the economics of existing processes.

The prospect of integration indicates that larger gas-making units centrally situated may be erected in the future, and the

experience of those undertakings, which already have a central gas producing plant from which the gas is pumped to outlying storage stations for local distribution, would indicate that the correct positioning of the benzole and gas drying plant is important. One would suggest the ideal sequence is that the gas should be stored wet in the works gasholders for the maximum removal of gum; that the gas from these holders should be passed through a dri-gas plant and subesquently a benzole plant before going to the boosters for distribution to the outlying stations. There are difficulties in the re-wetting of the gas by debenzolized oil, but these can be avoided by the use of a simple oil drier.

The authors pay justifiable tribute to the efforts of the Gas Research Board to solve current problems. Under the existing conditions in the industry, many attempts to solve the problems are made by individual undertakings without any co-ordination. The Council of the Gas Research Board is busy trying to improve this state of affairs, and one cannot but hope with the authors that under nationalization the scope of the Gas Research Board will be greatly extended. The authors have not given to the Institution the answers to the various problems which they pose, but the very fact of stating a problem will undoubtedly concentrate attention on it with, we hope, satisfactory results not only to the gas engineer, but also to the plant manufacturer.

Oxide Purification

Mr. **S. M. Milbourne**: The authors are certainly to be congratulated on the presentation of their review on purification and by-product recovery. There is only one section of this excellent paper on which I wish to comment, and that is Section VIII on oxide purification.

We are informed that development in tower purifiers is considerable. I presume this refers principally to Germany? Since the installation of tower purifiers dealt with by Colonel C. M. Croft in his paper read before the Institution about nine years ago, I cannot recall that any further purifiers of this type have been erected in this country. In the last few years numbers of purifying installations, both large and small, have been constructed or are in the process of construction in this country, but these are of the conventional or box type. From observation it would appear that the trend of design in purification plant for the removal of H_2S is more in the direction of the so-called "deep purifiers," of which there are several examples. Deep purifiers combine the simplicity of the ordinary shallow boxes with the advantages claimed for the tower purifiers. Not only do deep purifiers form a convenient and consistent method of extending existing installations of purification plant, but where ground space is restricted they may be readily constructed with a revivifying floor and also a roof overhead, thus enabling the small space available to be used to the very best advantage. The emptying and filling of the boxes or work on the preparation of the oxide can also proceed during the most inclement weather. From the constructional point of view deep purifiers have the advantage that the foundations are comparatively simple. The resisting properties of cast iron boxes to corrosion is unquestionable, while the comparatively small electrical units required for lifting and travelling the oxide are responsible for reducing the maintenance charges to the lowest possible amount.

I do not agree with the authors when they infer that oxide purification in the general way demands irregular calls for labour. In a recent installation of purifiers having a capacity of several millions of cubic feet of gas per diem the cast-iron boxes are 13 ft. deep and these are serviced with an oxide handling plant of simple design. These purifiers, together with a revivifying floor and roof overhead, occupy the minimum of ground space and can be serviced with a large or a small labour force whichever suits the convenience of the management.

In the short time available it is impossible to go further into these matters, but may I suggest, in concluding these remarks, that consideration is given to a paper on deep purifiers in the near future. There are some gas engineers who have special knowledge of this particular type of plant and who are, in fact, mainly responsible for its development. I am sure such a paper would be extremely valuable to the industry and would be much appreciated by the members generally.

The President: I understand that the authors would prefer to make their replies in writing.

T. C. Finlayson

GAS PRODUCTION IN PERSPECTIVE*

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PERSPECTIVE has been defined as "the inter-relation in which parts of a subject are mentally viewed." It is with this approach that the authors have attempted to survey the extensive subject of gas production.

The subject can be looked at from three angles—statistical, technical, and economic. It is possible to view the first two aspects in some perspective, but unfortunately the third aspect is in a state of confusion and rapid change which makes it impossible at the moment to see any clear picture. Frequent changes in the prices of coal, coke, oil, labour, and plant make any figures for cost of gas production only of a transitory value and not worthy of permanent record in the Transactions of this Institution.

The authors have, therefore, decided with regret that the subject of economics of gas production must be omitted from this paper, and they trust that in the near future such stability may be attained in price levels of the various components of gas production as will enable some member of the Institution to give an assessment of this important matter.

During the last 140 years the gas industry has grown steadily until in 1945 it was responsible for supplying 2,022 mill. therms of gas. Of this quantity, approximately 1,750 mill. therms were manufactured on gas-works, the remainder being purchased from coke ovens. The gas industry carbonized approximately 21 mill. tons of coal, and in doing so produced for sale the following approximate additional quantities of fuel and chemicals:—Coke, 11 to 12 mill. tons; tar, 250 mill. gal.; benzole, 33 mill. gal.; ammonia, 56,000 tons, and sulphur, 120,000 tons.

The framework in which this development has taken place, as it affects the methods of gas production, well repays study. First, the raw material of the gas industry, coal, which is found widely distributed throughout the country, varies considerably in physical and chemical properties. It has been the aim of designers to produce carbonizing plants which can deal efficiently with a large variety of coals. Second, the gas industry sets out to ensure to the community an uninterrupted supply of gas which is constant in quality and which can be obtained on immediate demand in whatever quantity may be required. The hour-to-hour demand varies very greatly and is met by storage arrangements. The daily variation, however, imposes a degree of flexibility which has influenced the design of the carbonizing plant and has led to the employment of auxiliary methods of gas manufacture which can be rapidly brought into production to meet the peak loads. The requirements of uninterrupted supply has influenced the search for improved constructional materials and methods of control and maintenance. Third, there has been a growing demand in this country for an alternative solid fuel to coal. It has been the experience of the gas industry that cultivation of the coke market so that the highest monetary return possible is obtained for the solid residue of carbonization

* Communication No. 334 of the The Institution of Gas Engineers, presented at the Annual Meeting, London, June 8, 1948.

leads to the cheapest cost of gas production. The industry, therefore, has developed along the lines of a two-fuel industry. The form of gas-making plant has been determined accordingly. Finally, the gas industry, now within measurable distance of its triple jubilee, has operated under statutory control in relatively isolated units. Though of late years there has been an accelerated tendency towards amalgamations the industry still comprises a large number of independent units varying enormously in size. The size of undertaking influences the type of plant adopted for gas production.

It is possible now to pass to an examination in more detail of the various features of the gas industry which are to be found within the framework briefly dealt with above.

Coals Used in the Gas Industry

The gas industry prefers coals which give a good thermal yield of gas and make a reasonably strong coke with a reasonably low ash content. Such coals have volatile contents of 32 to 36%, and B.S. swelling numbers from 3 to 9. The economic advantages offered by the proximity of coalfields to gas undertakings may lead to the employment of coals outside this range of properties.

Table 1 has been prepared from published data to show from which coal-producing areas the gas-works in the various coal-utilization regions draw their supplies. The figures in italics show the proportion of the coal received by gas-works in a particular utilization region which is drawn from the coal-producing area lying within that region. It is obvious, that, wherever possible, gas-works draw on local supplies. Where these are inadequate in quantity or unsuitable for gas manufacture additional supplies are obtained from the Yorkshire and Derbyshire and the Durham coalfields. Gas-works in the eastern, south-eastern, southern, and south-western parts of the country (including London) depend for their supplies of gas coal on the Durham coalfield if they are conveniently situated for seaborne traffic, and on the Yorkshire and Derbyshire coalfields if supplies are railborne.

Coals with volatile contents above about 36% are seldom used for gas manufacture, since, quite apart from the fact that the coke is generally of inferior nature due to the lower coking properties of these coals, the thermal yield of gas per ton of coal and the calorific value of the straight gas are lower than in the case of a good gas coal. Thus, the yield of gas on dilution to any given calorific value is reduced. The gas industry might well be able to use increased quantities of such coals in horizontal retorts and intermittent vertical chambers by blending them with coals having good coking properties if a price structure could be arranged which took into account their inferior gas-making properties.

The gas industry as a whole drew its supplies of coal in 1945 in the following grades—:

	%
Large (including Hards and Cobbles)	14.2
Unscreened	34.0
Graded	48.3
Slacks and Smalls	3.5
	100.0

About 76% of the unscreened coal used in the gas industry represented Durham run-of-mine coal, while about 70% of the graded coal came from the Yorkshire and Derbyshire coalfields.

The relative merits of different forms of carbonizing plant in handling various grades of coal have been discussed on many occasions. The performance of horizontal retorts and intermittent vertical chambers is little affected by the grading of the coal whether the coal be strongly or feebly swelling. It may, however, be advisable to draw attention to the fact that coals having swelling-numbers of 9, especially those having volatile contents below about 28%, may give rise to undesirable pressures on the walls of intermittent vertical chambers during carbonization.

For ease of travel and maximum gas output per retort per day in continuous vertical retorts, graded coal is to be preferred and will give a gas output 10% greater than that of run-of-mine coal.

Nevertheless, run-of-mine coals of the Durham, South Wales, and Somerset varieties are being carbonized regularly in continuous vertical retorts. It has been estimated that more than 25% of the Durham run-of-mine coal supplied to the gas industry is now being carbonized in continuous vertical retorts.

Gas Making Plant Used in the Gas Industry

There are five main types of gas-making plant used in the gas industry, and their relative importance can be seen from Table 2, in which is shown the approximate quantities of gas made in each type of plant in 1945.

It is of interest to note the distribution of these different forms of gas-making plant throughout the industry, and to consider the particular characteristics of each type of plant which have determined their use.

TABLE 2.—*Estimated Quantities of Gas Made in Various Types of Gas-making Plant in* 1945.

Plant	Percentage of total gas made
Continuous vertical retorts	42
Horizontal retorts	32
Intermittent vertical chambers, static verticals, and others	6
Coke ovens (on gas-works)	2
Water gas plant (using coke) Tully plants, &c.	18
Total	100

Tables 3 and 4 have been compiled from various sources to show in what proportion the different forms of gas-making plant have been adopted by different size-groups of gas undertakings in England and Wales and in Scotland. The size-groups vary from very small undertakings having outputs of less than 25 mill. cu.ft. of gas per year to very large undertakings with outputs of more than 5,000 mill. cu.ft. of gas per year. In col. 2 of each table appear the number of undertakings which fall in each size-group. In cols. 3 to 11 in Table 3 and in cols. 3 to 6 in Table 4 are given the percentage of these undertakings which employ the various forms of gas-making plant. The small figures in brackets indicate the percentage of each category of carbonizing plant which uses a water-gas plant as an auxiliary means of gas making.

Cols. 3 to 5 in Table 3 show that, in England and Wales, undertakings with outputs up to 500 mill. cu.ft. per year with very few exceptions employ only one form of carbonizing plant.

In the very small works (less than 25 mill. cu.ft. per year) horizontal retorts are used exclusively. As the size of undertaking increases, the proportion of undertakings which depend on horizontal retorts decreases, while that which depends on

TABLE 1.—*Percentage of the Coal used in Gas-works in the Various Coal-utilization Regions Drawn from the Various Coal-producing Areas in* 1945.

Coal-producing areas	Percentage of coal used in gas-works in each Region in 1945												
	Northern	North-Eastern	North-Midland	North-Western	Midland	Eastern	London	South-Eastern	Southern	South-Western	Wales North	Wales South	Scotland
Northumberland and Durham	*92.5*		0.1	6.1	0.8	10.25	83.8	70.0	52.3	12.6			10.5
Yorks, Derby, Notts, &c.	7.5	*99.5*		57.5	71.6	89.75	16.2	19.2	45.1	55.3	25.8	12.8	
Cheshire, Lancs, Cumberland ...				*30.2*									
Staffs, Warwick., &c.			0.4	4.5	*26.0*				0.6		6.6	0.4	
Kent								*10.8*					
Somerset, &c. ...					0.2				2.0	*30.0*		1.1	
Wales (North) ...				1.7	1.3						*67.6*	2.6	
Wales (South) ...					0.1					2.1		*83.1*	
Scotland													*89.5*
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

The figures in *italics* show the proportion of the coal received by gas-works, in a particular utilization region, which is drawn from the coal-producing area lying within that region.

TABLE 3.—*Distribution of Various Types of Carbonizing Plant According to Size of Undertaking, Showing also the Incidence of Water-Gas Plants, in England and Wales.*

Annual output (million cu.ft.)	No. of undertakings taken into account	Undertakings with only one type of carbonizing plant			Undertakings with two or more types of carbonizing plant						Total
		Horizontal only	C.V.R. only	I.V.C. only	Horizontal and C.V.R	Horizontal and I.V.C..	Horizontal and S.V.	Horizontal, C.V.R. and I.V.C.	Horizontal, I.V.C. and S.V.	Horizontal, C.V.R., I.V.C., C.O.	
		%	%	%	%	%	%	%	%	%	%
Less than 25 ...	282	100 (nil)	—	—	—	—	—	—	—	—	100.0
25 to 50 ...	120	87.5 (14.3)	10.0 (8.3)	1.7 (50.0)	0.8 (nil)	—	—	—	—	—	100.0
50 to 100 ...	88	70.5 (33.9)	26.1 (8.7)	2.3 (nil)	1.1 (nil)	—	—	—	—	—	100.0
100 to 250 ...	128	52.4 (41.8)	43.0 (30.9)	2.3 (nil)	2.3 (nil)	—	—	—	—	—	100.0
250 to 500 ...	56	42.8 (66.6)	50.0 (68)	3.6 (50)	1.8 (100)	1.8 (100)	—	—	—	—	100.0
500 to 1,000 ...	53	26.4 (78.5)	50.9 (55.5)	*3.8 (50)	17.0 (66.7)	1.9 (100)	—	—	—	—	100.0
1,000 to 2,500 ...	41	19.7 (75.0)	51.3 (78.0)	2.4 (66 0)	14.6 (83.0)	4.8 (100)	2.4 (100)	2.4 (nil)	2.4 (100)	—	100.0
2,500 to 5,000 ...	12	8.3 (100)	33.4 (100)	—	25.0 (100)	8.3 (100)	16.7 (100)	8.3 (100)	—	—	100.0
More than 5,000...	10	10.0 (nil)	—	—	60.0 (100)	10.0 (100)	—	10.0 (100)	—	10.0 (100)	100.0

* Includes one inclined chamber plant.
Figures in brackets show the percentage of each category of carbonizing plant which works in conjunction with a water gas plant.

Notes.—Horizontal = Horizontal retorts.
C.V.R. = Continuous vertical retorts.
I.V.C. = Intermittent vertical chambers.
S.V. = Semi-continuous or static verticals.
C.O. = Coke ovens.

continuous vertical retorts increases. There is also a gradual increase in the proportion of undertakings which uses intermittent vertical chambers alone, but this proportion never reaches a high figure.

Undertakings having annual outputs greater than 500 mill. cu.ft. make increasing use of more than one type of carbonizing plant, but the important part in these combination plants which is assumed by continuous vertical retorts is clearly to be noted.

Water-gas plant is not employed by any English or Welsh undertaking which has an annual output below 25 mill. cu.ft. As the annual output increases, the proportion of the undertakings which make water gas increases. All undertakings which have annual outputs greater than 2,500 mill. cu.ft., except one, obtain a portion of their requirements from water-gas plants.

The gas undertakings in Scotland when classified in the same way as those in England and Wales (Table 4) show a similar general trend with, however, one or two distinctive differences. For example, continuous vertical retort plants have been adopted by undertakings with annual outputs of less than 25 mill. cu.ft. Further, all undertakings with annual outputs between 250 and 5,000 mill. cu.ft. employ only continuous vertical retorts. There is a small proportion of the undertakings having annual outputs below 50 mill. cu.ft. which depends entirely on a form of complete gasification

Characteristics of Various Types of Gas-Making Plant

It is obvious from a consideration of the way in which the various types of plant are employed in the gas industry that gas engineers have exercised a choice between the available forms of gas-making plant, and it is of interest to consider the outstanding characteristics of the most important types. The plants will be dealt with in the order in which they appear in Table 2.

(A) CONTINUOUS VERTICAL RETORTS

The important place which this type of plant has now assumed in the gas industry is due to a combination of factors which may be summarized as follows:—Broadly, the continuous vertical retort is able to produce gas of a constant calorific value at a regular rate, and the calorific value can be chosen from a relatively wide range to suit local circumstances. The output of gas per unit of ground space is the highest of any form of carbonizing plant. The throughput of individual retorts varies from 3 to 12 tons per day. The adaptability of the continuous vertical retort to the steaming process enables a high yield of therms per ton of coal to be obtained consonant with the type of coal treated and calorific value of gas chosen. Extended experience with this type of retort has shown that the coke has improved properties as regards ignitability and combustibility. The continuous vertical retort offers, in the relative absence of arduous and unpleasant conditions associated with charging and discharging of retorts, an improved standard of amenity. The outstanding contribution of this type of retort to the question of fuel economy is dealt with in a later section.

(B) HORIZONTAL RETORTS

This form of carbonizing plant has been employed by the gas industry since its early years and has been thoroughly modernized. Its essential characteristic is its ability to treat a very wide variety of coals and to obtain a high yield of straight coal gas at a relatively high calorific value. In spite of experimental work, the horizontal retort has not proved itself adaptable to the steaming process and depends on external means such as benzole recovery, or dilution by water gas or producer gas, for reducing the calorific value of the gas to the usual standards adopted in the gas industry. Horizontal retorts have the advantage of a high degree of flexibility in output, which subject is dealt with at a later stage. Horizontal retorts can, moreover, be built in small units, a feature which, together with the relatively simple technique of operation, has made it peculiarly suitable for the smallest gas works. The throughput of individual retorts varies from 1·0 to 2·5 tons per day. The ground space occupied per therm of gas made is about twice that for continuous vertical retorts.

(C) INTERMITTENT VERTICAL CHAMBERS

The intermittent vertical system of carbonisation was introduced into the gas industry somewhat earlier than the continuous vertical system. It has many of the characteristics of the horizontal retort—namely, the ability to produce a high yield of high calorific value straight coal gas from a wide variety of coals. There is an added advantage in that the intermittent vertical chamber can be steamed and thus is able to produce gas with a wide range of calorific values without external means of dilution. Economic considerations tend to limit the amount of steaming adopted in practice, and the principal intermittent vertical chamber plants are producing gas with a calorific value generally in excess of 500 B.Th.U. per cu.ft. The throughput of individual chambers varies from 1·5 to 8·0 tons per day. The ground space occupied by plant per therm of gas made lies about half way between the figures for continuous vertical retorts and horizontal retorts.

Under this heading some reference should be made to the modification in which an intermittent vertical chamber is provided at its lower end with a coke-cooling chamber. While a charge of coal is being carbonized, the hot coke from the previous charge, which has been lowered into the cooling chamber, is being cooled by steam, the resulting water gas and uncracked steam passing up through the new charge. The coke is removed in the cooled condition. This form of plant was devised to combine the advantages of high thermal yield at any given calorific value obtainable from intermittent vertical chambers with the discharge of cooled dry coke associated with continuous vertical retort practice. The commercial plants in operation have attained these technical objectives, but the inherently higher capital cost of the plant can, it appears, be justified only in special circumstances.

(D) COKE OVENS

Only one gas undertaking is at the moment operating this type of carbonizing plant on a gas-works. Coke ovens are

TABLE 4.—*Distribution of Various Types of Carbonizing Plant According to Size of Undertaking, Showing also the Incidence of Water-Gas Plants, in Scotland.*

Annual output (million cu. ft.)	No. of undertakings taken into account	Undertakings with only one type of carbonizing plant			Undertakings with two or more types of carbonizing plant	Total
		Horizontal only	C.V.R. only	C.G. only	Horizontal C.V.R. and I.V.C.	
		%	%	%	%	%
Less than 25	76	93.4 (16.9)	2.6 (nil)	4.0	—	100.0
25 to 50	38	78.9 (46.7)	10.5 (nil)	10.6	—	100.0
50 to 100	25	48.0 (75)	52.0 (nil)	—	—	100.0
100 to 250	28	17.9 (60)	82.1 (26.1)	—	—	100.0
250 to 500	8	—	100 (25.0)	—	—	100.0
500 to 1,000	7	—	100 (28.6)	—	—	100.0
1,000 to 2,500	2	—	100 (50)	—	—	100.0
2,500 to 5,000	1	—	100 (100)	—	—	100.0
More tha 5,000	1	—	—	—	100 (100)	100.0

Figures in brackets show the percentage of each category of carbonizing plant which works in conjunction with a water gas plant.

Notes.—Horizontal = Horizontal retorts.
C.V.R. = Continuous vertical retorts.
I.V.C. = Intermittent vertical chambers.
C.G. = Complete gasification.

most suitable for large-scale operation. The carbonizing units are large, a single oven carbonizing up to 20 tons of coal per day. Coke ovens can carbonize a wide range of coals as long as the coals give, when coked, a strong enough coke to withstand pushing. They are, therefore, more selective in the types of coal which can be treated than are intermittent vertical chambers. Coke ovens produce a high calorific value gas. Coke ovens on gas-works differ from other forms of carbonizing plant in this country in so far as they are heated by cold clean producer gas which is preheated in regenerators built as an integral part of the battery. The coke oven battery and its machinery occupy a large amount of space, but where this is no disadvantage and when the plant is of a sufficiently large size, the economies in labour and maintenance make coke ovens an attractive proposition. The throughput of individual ovens varies from 10 to 20 tons per day.

(E) WATER-GAS PLANT

The majority of gas undertakings having annual outputs greater than 250 mill. cu.ft. make some proportion of their output in the form of water gas, usually carburetted. As a general rule the larger the undertaking the more customary it is to make water gas.

The carburetted water-gas process was introduced into this country largely as a means of enriching coal gas to meet the then ruling "illuminating power standard" (the amount of oil used being generally from 2 to 4 gal. per 1,000 cu.ft. of gas) and, also, as a means of meeting peak loads. Following the introduction of the thermal basis for the sale of gas, the rôle played by carburetted water-gas plant has changed and it is employed mainly as a very flexible means of meeting peak-load demands, of diluting high calorific value coal gas (using on the average 1·0 to 1·5 gal. of oil per 1,000 cu.ft.), and of controlling the amount of coke for sale.

The flexibility of the carburetted water-gas plant arises not only from the ease and speed with which the plant can be started up and shut down, but from the rapid increase in thermal output which can be obtained by increasing the amount of oil used per 1,000 cu.ft., though, of course, the calorific value of the gas increases accordingly. As an example of this method of increasing output, by raising the oil used per 1,000 cu.ft. of carburetted water gas from 1 gal. to 2 gal., the thermal output of the water-gas plant is increased by about 40%.

During the past 25 years many important technical and constructional improvements have taken place which greatly increase the efficiency of the process. These improvements include the provision of mechanical means of coke charging and ash removal, the adoption of waste-heat boilers and of water-jacketed producers, and the introduction of the back-run system of operation.

The extent to which these improvements have been adopted by the gas industry can be appreciated from the fact that the average make of water gas per ton of coke, taken over the whole country, has increased from about 40,000 cu.ft. in 1921, to nearly 53,000 cu.ft. in 1944.

Some Important Aspects of Gas Production

(A) FUEL ECONOMY

The four main systems of high-temperature carbonization used in the gas industry to-day are

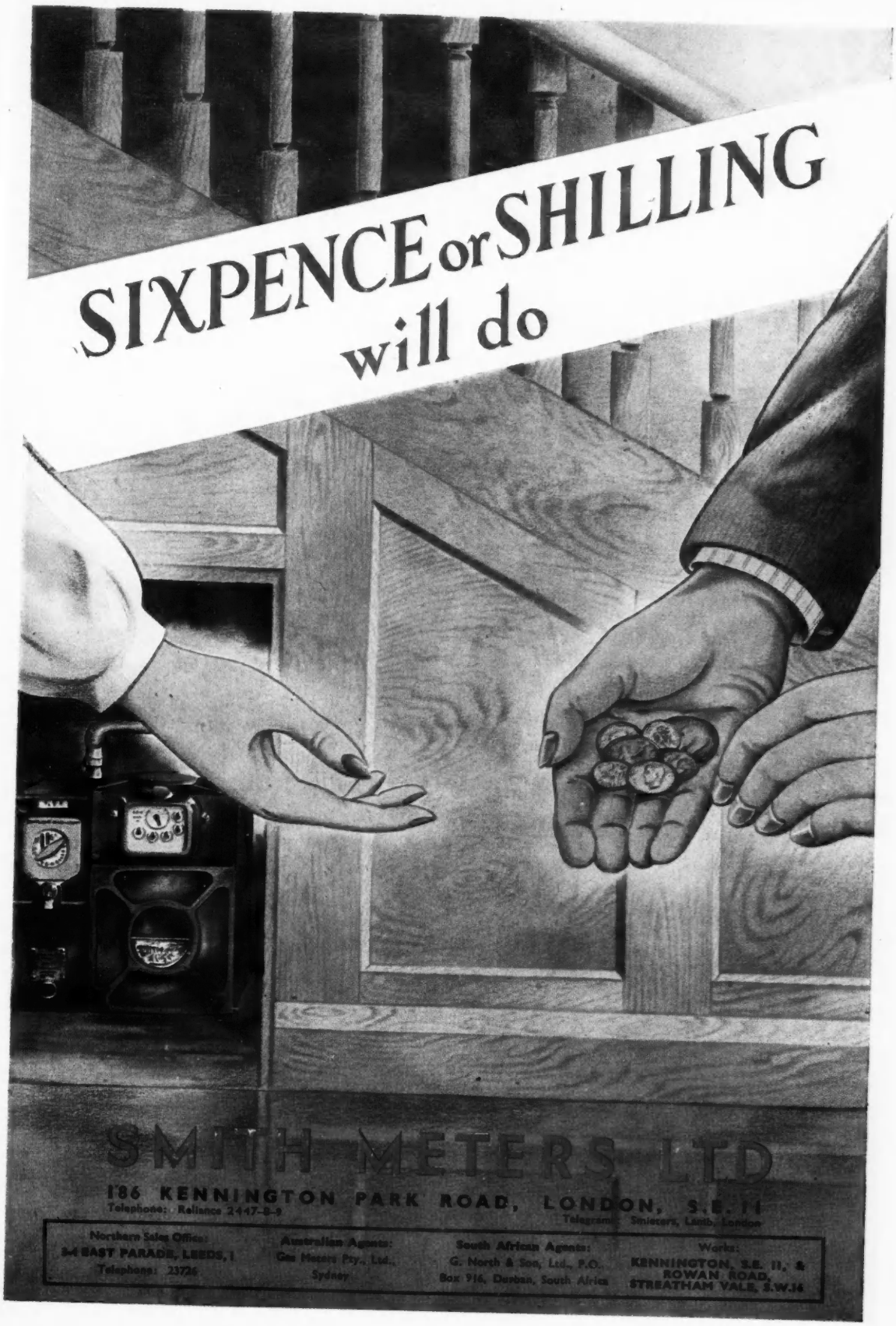
(1) non-recuperative continuous vertical retorts,
(2) recuperative horizontal retorts,
(3) recuperative intermittent vertical chambers, and
(4) regenerative coke ovens.

One of the authors has recently discussed the general subject of "Fuel Economy in Coal Carbonization."[2]

Table 5 sets out the comparative fuel requirements per ton of coal for the above four systems under conditions of best modern practice, based upon Pexton's[3] data. Paradoxical as it may seem, the amount of producer fuel used by the non-recuperative continuous vertical retorts is practically as low as that required by the regenerative coke oven and is appreciably lower than that used by the two recuperative systems. The primary reason lies in the fact that in the continuous vertical retort there is a continuous counterflow of heat between the descending coke inside the retort and the secondary air ascending through suitably disposed heating ducts around the retorts. There is also some interchange of heat between steam and hot coke at the bottom of the retort, and between coal and volatile gases at the top of the retort. The other three systems, which all discharge red-hot coke, do not give the same opportunity for heat exchange between the secondary air and the hot coke. The temperature of the crude gas leaving the carbonizing chambers is also higher in static forms of carbonizing plant. For these reasons, the heat used in the continuous vertical retort per ton of coal is only 14 therms against 24 therms required by horizontal retorts and intermittent vertical chambers, and 20 therms required by coke ovens. These basic differences in heat used lead to the general acceptance of different principles of design. With horizontal retorts and intermittent vertical chambers it is usual to provide recuperators to recover a proportion of the heat from the waste combustion gases by preheating the secondary air. The waste gases leave the recuperators at a temperature of about 600° C. In continuous vertical retort settings the secondary air is preheated to a sufficiently high temperature without any need to use the heat from the waste combustion gases, which are therefore available at their full temperature of about 1,000° C. for steam raising.

In the case of modern regenerative coke ovens the position is a little different. First, the producer gas is made in mechanical producers and is cooled and cleaned before delivery to the battery. There is a consequential loss of heat. This is made good by preheating the producer gas as well as the secondary air, and in doing so the temperature of the waste gases is reduced to about 300° C., which does not permit of any steam raising.

Thus, although the heat used in the continuous vertical retort represents only 43% of the fuel to producers against 60 to 64·5% in the case of the recuperative or regenerative systems, because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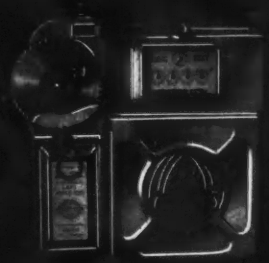

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of the smaller amount of heat required in the continuous vertical retort, the producer fuel requirements per ton of coal carbonized for this type of plant are practically the same as for the regenerative coke oven and are lower than those of the two recuperative systems. Moreover, with continuous vertical retorts it is possible to raise steam to the extent of 10 therms per ton of coal against no steam in the case of regenerative coke ovens and about five therms in the case of the two recuperative systems.

TABLE 5.—*Comparative Fuel Requirements of Four Systems of High-temperature Carbonization*

		Non-recuperative continuous vertical retorts (slight steaming)	Recuperative horizontal retorts	Recuperative intermittent vertical chambers (slight steaming)	Regenerative coke ovens
1	Type of plant				
2	Overall heating efficiency of carbonizing system (%) ... $\left(\frac{\text{Heat utilized} \times 100}{\text{Heat in coke to producers}}\right)$	43	60	62	64.5
3	Heat used (therms per ton of coal):				
	Hot coke	6.0	10.9	10.7	11.3
	Crude coal gas	3.5	6.4	6.4	6.1
	Radiation, &c., loss	4.6	7.1	5.6	3.1
	Steam reaction	—	—	1.0	—
	Total heat used	14.1	24.4	23.7	20.5
4	Fuel to producers (allowing for heating efficiency of carbonizing system (2) (therms per ton of coal)	33	41	38	32
5	*Less* Waste-heat steam recovered (therms per ton of coal) ...	10	5.5	5	—
6	*Net* Fuel consumption (allowing for steam production) (therms per ton of coal) ...	23	35.5	33	32
7	*Less* Steam recoverable by dry cooling of coke (therms per ton of coal)	—	6.0	7.2	7.5
8	Overall net fuel consumption (allowing for waste-heat steam and dry-cooling of coke) (therms per ton of coal) ...	23	29.5	25.8	24.5

It can be calculated from Table 5 that in the case of plants discharging red-hot coke it is possible to recover in the form of steam approximately 20% of the heat supplied in the form of producer fuel by the adoption of dry coke cooling. Fuel economy by dry coke cooling is not attained without some disadvantages, in particular a substantial increase in capital cost, an appreciable maintenance cost, and a limitation in the permissible volatile content of the coke made.

It is possible to recover as steam a portion of the heat lost in cooling the producer gas used for heating the coke ovens, but this steam or its equivalent is required to drive the air blowers and producer-gas fans of the producer plant.

One of the most promising directions for further fuel economy in coal carbonization is by proper co-ordination of process steam and power requirements of the gas-works. Pexton[3] has made valuable suggestions in this connexion. It would lead us too far to enter into a detailed discussion of the question, but it may be useful to summarize the governing principles:

(1) All steam generated in waste-heat boilers should be required to do work before being used for process purposes.

(2) All steam should be produced at as high a pressure as is practicable. With the fire-tube type of boiler normally employed, pressure should not exceed 300 to 350 lb. per sq. in., according to size of boiler.

(3) Only sufficient units of plant should be steam-driven as will provide the low-pressure steam requirements of the particular works. All the remainder of the high-pressure steam should be passed to condensing turbo-generators.

By careful consideration of design of carbonizing plant and the power and steam requirements of a gas-works substantial fuel economies are still possible.

(B) CHOICE OF CALORIFIC VALUE

Since the passing of the Gas Regulation Act in 1920, each gas undertaking has been free to choose the calorific value of the gas it will supply throughout its area of supply. This has led to a diversity of declared calorific values varying from 200 to 600 B.Th.U. per cu.ft. However, 75% of the total gas sold in 1945 conforms to one of three standard calorific values—30% of the total at 450 B.Th.U. per cu.ft., 11·6% at 475 B.Th.U. per cu.ft., and 33·7% at 500 B.Th.U. per cu.ft.

In determining which declared calorific value to adopt in any particular instance, a number of factors have to be taken into account, such as the type of coals available and the type of carbonizing plant installed, economic factors such as the prices of coal and coke and the state and adequacy of the distribution system. No hard and fast rules can be laid down. It is of interest to note that the majority of undertakings which depend either wholly or for a large proportion of their requirements on purchased coke oven gas have adopted a calorific value of 500 B.Th.U. per cu.ft.

The question of control of calorific value raises the subject of dilution. The continuous vertical retort offers the most convenient way of producing in a single stage a gas with a calorific value below 500 B.Th.U. per cu.ft. With coals such as South Midland, Yorkshire, and Scottish, steaming down to 425 B.Th.U. per cu.ft. can be carried out; with coals such as those from Durham and South Wales, steaming cannot easily be carried below 475 B.Th.U. per cu.ft. Over these ranges of calorific values the daily output of therms per retort remains constant for each individual class of coal.

A wide range of calorific values can be obtained from intermittent vertical chambers. In this type of carbonizing unit steaming is only effectual after carbonization is complete, and the lower the average calorific value which is to be attained the longer is the charging cycle. The volume of gas per chamber per day remains constant irrespective of calorific value, that is, the thermal output falls in direct proportion to the calorific value.

In the case of horizontal retorts and coke ovens which give straight coal gas having a high calorific value and which do not lend themselves to steaming, a reduction in calorific value to the declared value is usually obtained by some form of external dilution, with or without benzole recovery.

The most usual means of dilution of horizontal and other high calorific value gas is by water gas which is generally carburetted to the extent of 1 to 1·5 gal. per 1,000 cu.ft. This means of dilution has proved to be a tactical weapon of great flexibility to meet the changes in output while maintaining a constant calorific value. By varying the calorific value of the water gas used for dilution it is possible to vary the output of a works by many per cent. even though the output from the coal gas plant has remained constant.

Of recent years there has been increased use of producer gas for dilution purposes. This is a convenient method of dilution, but is generally limited in amount on account of the resulting high content of inerts in the mixed gas. The same objection arises to the use of waste gases as a diluent.

It is increasingly evident that constancy of calorific value is not a sufficient criterion by itself for the attainment of constant combustion performance. While not wishing to deal in any detail with the question of the combustion characteristics of various gases, it may be permitted to draw attention to the conclusions of the 52nd Report of the Joint Research Committee of the Gas Research Board and the University of Leeds.[4]

The type of diluent gas used to reduce the calorific value is of overwhelming importance, and it is most desirable that a uniform scheme of attaining the declared calorific value should be adopted at any one works. The combustion characteristics (as measured by the A.T.B. Number) of coal gas diluted to a given calorific value by producer gas or water gas made by steaming in vertical retorts or blue water gas are reasonably constant, but the A.T.B. Number of carburetted water gas is definitely lower than that of coal gas or its diluted mixtures of equal calorific value.

(C) FLEXIBILITY OF OUTPUT

There are two aspects of flexibility to be considered—first, the variation in output from an individual carbonizing plant, which is dealt with in this section; and secondly, the variation in the relation between the amount of gas and the amount of coke made within the industry, which is dealt with in the next section.

Gas undertakings have to meet large variations in gas output throughout the year. Statistics show that the ratio between the maximum and the minimum day's send-out varies from about 1·8 to more than 4·0 with an average of 2·5 to 3·0. While holder capacity serves to cope with short-period fluctuations, it is necessary to be prepared to vary the output of the gas-manufacturing plant from full load to half load according to the season of the year.

With continuous vertical retorts these changes in output can be met by a judicious combination of reduction in the coal throughput, standing retort, or varying the scurfing programme.

Reduction in coal throughput is obtained by reducing the rate of coke extraction, the combustion chamber temperatures and amount of retort steam being adjusted to maintain the calorific value at the desired level. By such means the throughput of a retort may be reduced by 25 to 30% within 12 hr. while maintaining satisfactory retorting conditions. It may take up to 24 hr. to resume full throughput. At some sacrifice in gas yield, continuous vertical retorts may be worked at an overload of 5 to 10% above rated capacity. The possibility of varying the scurfing programme is of particular value for a gas undertaking which has a low week-end load. By concentrating the scurfing at week-ends it is possible to meet a 20 to 25% reduction in output while the full output of the plant is maintained during the week. It should be understood that the reduction in output due to week-end scurfing persists for 48 hr. and there are a further 24 hr. during which the output of the retorts put to work after scurfing is only 50% of the normal.

In the case of horizontal retorts flexibility of output is easily obtained by the procedure of "standing" beds of retorts uncharged, with suitable adjustments of the heating. Full output can be recovered rapidly after all the retorts have been recharged.

In the case of intermittent vertical chambers, the output of the plant can be reduced by 50% in 6 hr., and the output can be picked up to full in 12 hr. Such a reduction can be attained by discharging chambers as they become due and leaving them empty until only one-half the plant remains at work. As additional chambers are discharged the working chambers are concentrated into half the settings, the other half standing empty under reduced combustion chamber temperatures.

Coke ovens being designed in large units for the carbonization of relatively large quantities of coal have been treated in the gas industry as base-load plants, the output of which is altered by changing the carbonizing time. The slowing down of the cycle must be done in easy stages and is useful for meeting foreseen changes in demand. It is possible to reduce the output by one-third by increasing the coking time by one-half. It is not a usual practice to stand ovens empty. Coke ovens are, however, peculiarly suitable for attaining rapid flexibility in gas output by the use of coal gas firing, a subject which demands brief consideration.

Coke ovens can be designed for heating alternatively by coke oven gas or by producer gas in such a way as to allow any number of ovens in a battery to be heated by coal gas while the remainder are heated by cold producer gas from mechanical producers. The control valves are so arranged that a reduction to about 60% of full gas output can be carried out within half an hour of issuing the order. Coal gas firing involves the use of more coal and the production for sale of more coke per therm of gas sold than does producer gas firing.

Coal gas heating can be applied to continuous vertical or intermittent vertical carbonizing plants, and, in practice, up to 50% of the heating value of the fuel required for any setting can be supplied by introducing coal gas through the front wall of the step-grate producers. The coal gas is cracked in the hot fuel bed and mixes with the hot producer gas. Such a procedure is useful as a means of instantaneous reduction of the make of gas as, for example, a means of meeting the demand of a large user who requires gas for only a portion of each 24 hr.

(D) The Coke : Gas Ratio

There is general confidence that the demand for gas will continue to increase. Whether the demand for coke will increase to the same extent is a matter for argument. But it will not be questioned that the stability of the gas industry will be materially assisted by the extent to which the amount of coke for sale per therm of gas sold can be varied. Many of the modern developments in the gas industry have had this effect, as, for example, the production of carburetted water gas from coke, the freedom of choice in selecting the declared calorific value, and the adoption of steaming in continuous vertical retorts. It may be of some interest to examine the extent to which the gas industry has varied the amount of coke for sale per therm sold over two decades. Taking the 20-year period, 1921 to 1941, whereas the total amount of gas made and purchased by the gas industry rose by 44%, the coke and breeze for sale rose only by 20%. It has been estimated that if the gas made and purchased in 1941 had been replaced by coal gas as produced in 1921 there would have been approximately 6 mill. tons more coke and breeze for sale in 1941.

The fact that the total amount of coke and breeze for sale was not as high as could be computed from 1921 gas yields was due in almost equal measure to an increase in the yield of gas per ton of coal in carbonizing plants, to the production of a proportion of carburetted water gas, and to the purchase of increased quantities of coke oven gas.

(E) Improvements in Operating Conditions

It can be fairly claimed that the gas industry has been by no means backward in improving the conditions under which the various operations in the retort house have to be carried out. Mechanical charging and discharging of horizontal retorts has been applied for at least 50 years. The intermittent vertical chamber system uses gravitational means for the same ends. The continuous vertical retort by its very nature has set a new standard in respect of retort house conditions. Charging and discharging operations require no arduous efforts, and, moreover, the fumes and heat associated with these operations are largely eliminated. It is true that steam-quenched coke is often so dry that when it is discharged the dust is somewhat of a nuisance. Dust-collecting systems have been applied as counter measures.

For many reasons, the British gas industry has used the static refractory-lined producer to the exclusion of any other type. Greater appreciation of the principles of design which led to the development of the step-grate producer of ample area and correct shape has resulted in elimination of much of the arduous nature of producer attention. Nevertheless, gas engineers are attracted to the idea of employing the mechanical producer so arranged that coke feeding and ash removal is automatic and the labour required is confined to controlling the operation of the producer. As applied to continuous vertical retort installations, it is advantageous from the point of view of fuel economy and capital expenditure for the mechanical producers to deliver hot de-dusted gas to the setting. Mechanical producers have proved successful on the Continent on many installations, and it will be of the greatest interest to find out by practical experience in this country how far the improvement in conditions justifies the extra capital cost involved.

The improvement in operating conditions associated with the charging and discharging of continuous vertical retorts left unsolved the discomfort caused by the heat radiated from the hot retort bench. It has to be admitted that the modern trend of designing compact settings using higher carbonizing temperatures and the introduction of non-recuperative settings with waste-heat boilers has intensified the problem. Increasing attention has been paid in recently built plants to ameliorating the sultry retort house conditions by providing adequate insulation and natural ventilation and by arranging in designing the plant that the heated convection currents of air shall as far as possible be led away from the operating floors and platforms. At positions where such means are not effective, arrangements have been made to direct artificially produced streams of cold air along the surface of walkways and to damper platforms.

(F) Coke Quality

At first sight it may seem strange that the gas industry should supply coke for purposes such as space and water heating when gas is so much cleaner and more convenient. The indisputable fact of the present position is that no process has yet been commercialized which will produce town gas as cheaply as high-temperature carbonization, which involves the production of approximately two therms of coke for every therm of gas made. There is, therefore, no doubt that the gas industry has taken the right lines in placing emphasis on improvement in coke quality and in seeking satisfactory markets for its coke. From the point of view of the consumer the gas industry has grown to be regarded as a "two-fuel" industry—gas and coke. Improvements in coke quality have been directed towards the supply of correctly graded fuel with low ash and moisture contents and with improved combustible properties. Low ash content in coke depends upon the use of coal itself with low ash content; the carbonization process cannot be expected to "up grade" the solid residue. The gas industry has in the past been able to press for the supply of low ash coals and to use large quantities of screened gas coals or graded nut coals. The maintenance of good coke quality in the future depends upon the gas industry receiving coals with low ash content.

Coke with a low moisture content is obtained by steam quenching or controlled water quenching in continuous vertical retorts. It is more difficult to attain a low moisture content in the coke from horizontal retorts unless special dry-quenching plant is installed. In coke oven practice, the large bulk of

coke dealt with at one discharge (it may be as much as 10 tons) lends itself to controlled water quenching, and the standard arrangements enable the coke above nut size to be obtained with less than 5% moisture.

The nature of the coal, the type of carbonizing plant, and the conditions under which the coal is carbonized, all play a part in determining the properties of the coke. Generally speaking, the feebler-caking coals give a coke with a porous micro-structure which shows a higher reactivity and superior qualities for the open grate, especially when carbonized in continuous vertical retorts. This same trend can be observed in coke from horizontal retorts, intermittent vertical chambers, and coke ovens, but the density of the coke made in these static types of carbonizing plants renders it more suitable for use in coke boilers and other furnaces where high reactvity is of less significance and where correct sizing and low ash content are more important factors.

Many attempts have been made to maintain coke reactivity while obtaining a good yield of gas per ton. Processes involving the addition of sodium carbonate to the coal charge before carbonization, or the spraying of the coke by a solution of sodium carbonate ; processes involving the practice of leaving two to three gaseous therms per ton in the coke, and the blending of non-caking coals with strongly caking coals before carbonization, have all been considered and to some extent adopted. Any extra cost in improving the reactivity of coke can only be justified if the resulting coke can command an appropriately increased price. This may well prove a limiting factor in the development of such processes.

Future Possibilities of Gas Production

So far, this paper has been confined to dealing with some of the significant features connected with the current practice of gas manufacture. The question naturally arises as to the direction which future progress is likely to take. The authors disclaim both the ability and the desire to prophesy, but, as there are a number of proposals for new methods of gas manufacture before the gas industry, they may be allowed to discuss these proposals and throw them into perspective with established forms of gas manufacture.

(A) Means of Controlling the Coke : Gas Ratio

As has been mentioned in the section on the coke : gas ratio, the gas industry should be prepared to meet a largely increased demand for gas, possibly unaccompanied by a corresponding expansion of the coke market.

It is necessary, therefore, to consider what means are now available to the gas industry should such an event happen in the next few years. It is also necessary to consider whether the gas industry, as a long-term policy, should develop along the lines of complete gasification.

It will be conceded that many years must elapse before the industry can be re-equipped with a completely new and possibly revolutionary system of gas manufacture even when such a system has emerged from the experimental stage. It seems certain that, for a number of years, the existing forms of gas-making plant will continue to be built as replacements and extensions on existing works and as new construction on any new centralized works which may be the outcome of regional grouping. It is reasonable to expect that the trend which has been experienced during the last 40 years will be continued—namely, the further adoption of continuous vertical retort and intermittent vertical chamber plants up to quite large capacities. For the largest base-load plants one may expect an increase in the use of coke ovens.

In connexion with these systems of carbonization there are two established ways of increasing the amount of gas sold without increasing the amount of coke for sale. There is on the one hand the use of carburetted or blue water gas which can be adopted with all forms of carbonizing plant. By adjusting the calorific value of the carburetted water gas, the proportion of this gas can be increased to a point where there would be no coke for sale.

It must, however, not be overlooked that those systems which enable steaming to be carried out (for example, continuous vertical retort and intermittent vertical chamber plants), can be operated to permit a change in the ratio between the amount of gas and coke available for sale if the gas undertaking finds it practicable to reduce the declared calorific value. For example, by reducing the declared calorific value in the intermittent vertical system from 500 to 450 B.Th.U. per cu.ft. the quantity of gas available for sale can be increased from 153 therms to 200 therms for each ton of coke for sale; that is, by about 30%.

The two methods of adjusting the ratio of gas to coke for sale mentioned above suffer from certain limitations. The use of carburetted water gas depends on the availability of oil which has to be imported. The reduction in calorific value by increased steaming of the charges in vertical systems of carbonization cannot in practice be taken too far.

The purchase of coke oven gas is obviously another means of increasing the supply of gas available for sale by the gas industry without increasing the coke to be sold by the gas industry. This question is dealt with later in this section.

(B) New Processes of Gas Production

If a scheme could be devised of increasing the calorific value of blue water gas by combining part of the carbon monoxide and hydrogen to form methane the objections to using imported oil or to changing the declared calorific value could be overcome. The Gas Research Board has been actively engaged in investigating the possibilities in this direction by passing blue water gas over a catalyst. The first problem which confronted the investigators was to discover a catalyst which had a satisfactorily long life. Success seems to have been achieved, providing the water gas is substantially free from all sulphur compounds. There are, however, certain practical problems which have to be dealt with when the process is applied on the large scale. The potential heat contained in the methane produced is only 78% of that contained in the hydrogen and carbon monoxide which enter into combination.

The reaction, therefore, is accompanied by the evolution of considerable heat which must be usefully used if the process is to be economical. It is proposed to use this heat for raising the steam required by the water-gas plant, while the blow gases will be used to preheat the blast. The other practical consideration is the preparation of the catalyst, which will require carefully controlled centralized production if the process is adopted on the large scale. When the process has been developed to a commercial stage its adoption will depend partly on the national policy regarding the importation of gas oil, and partly on the economics of the process as an alternative source of "enrichers."

The foregoing processes are essentially linked with the use of the normal forms of carbonizing plant. The development in Germany during the last 10 years of gasification under high pressure (300 lb. per sq. in.) prompts the question whether this may not offer a solution to the problem of increasing the supply of gas without increasing the supply of coke. The Lurgi high-pressure gasification process, which has been commercially applied only to the treatment of lignite, consists in passing a preheated mixture of steam and oxygen continuously through the fuel bed at high pressure. Under these conditions the reactions in the fuel bed are so influenced as to favour the production of methane and carbon dioxide. The final gas, after removing the carbon dioxide, has a calorific value and specific gravity similar to those of a normal town gas. It has been claimed as a subsidiary advantage that most of the hydrogen sulphide can be removed under pressure by washing with water, and that, consequently, purification costs will be reduced; moreover, since the gas is produced at high pressure, that it can be distributed cheaply over long distances.

A study of the available information suggests that to obtain a proper perspective on this process the following features require noting :—

(1) The process depends on using medium-purity oxygen, say, 85 to 98% purity. The power required by such a plant is high, and only by strict co-ordination of power and process steam supplies would it be possible to avoid a heavy running cost.

(2) The process must be operated on a large scale, probably 30 to 50 mill. cu.ft. per day output, so that the provision of the oxygen plant in several units to give flexibility and continuity of supply is economically possible.

(3) Practical experience with bituminous coal is required.

(4) The carbon dioxide and hydrogen sulphide which are removed by washing the gas with water under pressure are given off from the water after it has left the washing tower. There will be 3 to 4 mill. cu.ft. of a mixture of carbon dioxide and hydrogen sulphide gas (containing up to 1% hydrogen sulphide) for every 10 mill. cu.ft. of finished gas made, and the most practicable way of dealing with this gas has yet to be ascertained.

(5) The effluent liquor has a very low ammonia content and in quantity per therm of gas appears to be twice that which has to be dealt with from normal high-temperature carbonization plant. It is very high in phenol content.

The subject of high-pressure gasification of coal, including the production of methane by the reaction of hydrogen on coal under conditions of high pressure is under active investigation by the Gas Research Board, and the above problems will no doubt be considered by it. Once the high-pressure gasification process in some form or another has reached a state of commercial development it may well play a part in a gas industry organized along regional lines, particularly if the demand for gas outstrips the demand for coke.

But, on present evidence, it is difficult to envisage this process producing a therm of gas substantially cheaper than that obtained by normal carbonizing methods, provided the coke can be sold.[6]

(c) The Purchase of Coke Oven Gas

The gas industry commenced to draw supplies from the coking industry some 40 years ago, but in 1921 the amount constituted much less than 1% of the total gas available for sale. During the last 25 years, which have seen a considerable degree of reconstruction in the coking industry, there has been a steady increase, so that to-day the amount of gas drawn from the coking industry amounts to 12 to 12·5% of the total gas available for sale by the gas industry. In fact, rather more than one-third of the increased amount of gas sold by the gas industry since 1921 has come from the coking industry. If the gas now obtained from the coking industry had been made by carbonization on gas-works, the gas industry would have required 3·25 mill. tons of coal, and there would have been for disposal another 1·5 mill. tons of coke and breeze.

It is, therefore, a matter of interest to estimate what further supplies of gas the coking industry could place at the disposal of the gas industry if this is deemed to be desirable after taking into consideration the capital charges and other costs involved. To arrive at any such figure, it is necessary to consider the present composition of the coking industry.

Coking installations are to be found, with few exceptions, either associated with collieries or associated with steelworks. Coke ovens, as regards their heating system, fall into three classes—regenerative combination ovens which are constructed to be heated by coke oven gas, or producer gas, or blast-furnace gas; regenerative non-combination ovens which are constructed to be heated by coke oven gas only; and waste-heat ovens, which require substantially all the coke oven gas made for heating the ovens. This last type of installation would require complete rebuilding before it could provide any gas for the gas industry. Moreover, waste-heat ovens account for only about 10% of the coal carbonized by the coking industry, and can, therefore, be left out of account as a source of gas for the gas industry.

There remain, therefore, the two classes of regenerative oven, the distinction being as follows:,

(1) Regenerative combination ovens have available for disposal about 55% of the total make of coke oven gas when they are heated by coke oven gas. They have available the total make of coke oven gas when they are heated by producer gas or blast furnace gas, but almost without exception the ovens operating at present under these conditions are situated at steelworks, and the whole of the coke oven gas available forms an integral part of the fuel balance of the steelworks. None of this gas is likely to be available to the gas industry. There still remain, however, a considerable number of regenerative combination ovens from which the whole of the coke oven gas could be rendered available by installing producers or cleaning equipment on blast furnace gas, together with the necessary gas connexions and control valves at the ovens.

(2) Regenerative non-combination ovens also have available for disposal about 55% of the total make of coke oven gas when they are heated by coke oven gas, but to render available the whole of the gas from this type of installation would entail major reconstruction of the battery and must be looked on as a long-term objective. The source of lean gas for heating the battery must also be provided.

A study of the information available[1] seems to suggest that there is a further potential supply of, possibly, up to 20,000 mill. cu.ft. per annum—that is, about 5% of the present output of the gas industry—by equipping existing combination ovens with the necessary supply of lean gas. If all the non-combination ovens were reconstructed to the combination type and put on lean gas firing a potential supply of a further 30,000 mill. cu.ft. per annum—that is, about 7·5% of the present output of the gas industry—could be rendered available. Reconstruction of the ovens for this purpose alone before the end of their useful life is highly unlikely, especially in view of the present shortage of refractory materials. In considering these figures, it must be appreciated that a number of the combination ovens are associated with steelworks which would probably require for their own use any extra gas rendered available by the further adoption of lean gas firing. Further, in certain instances, there are local difficulties in the conversion even of combination ovens for lean gas firing which will have to be taken into account. Finally, the present high cost of producer gas due to the prevailing price of coke is of the order of 5d. per therm, and any coke oven gas released by the adoption of producer gas firing must take this into account as well as the cost of transmission.

Looked at from a practical point of view, it is probable that the gas industry is already absorbing the bulk of the easily available supplies of coke oven gas, and that the average rate of increase during the last 25 years—namely, about 2,000 mill. cu ft. per annum—will not be exceeded in the future.

(d) Conclusion

The authors venture to suggest that for the next few years the methods of gas production employed will be such that, taking the industry as a whole, the amount of coke to be disposed of per therm of gas sold will remain substantially as at present.

The reasons for this view are:—

(1) The present unattractiveness of increasing the quantity of base-load carburetted water gas, owing to the high price of gas oil.

(2) The undeveloped state of the new processes of complete gasification, which would make gas without coke.

For the next few years, at least, the gas industry may be well advised, as mentioned in a recent paper,[7] to take advantage of the normal foresight of the public, whereby the excessive peak demands for winter space heating are met by supplies of solid fuel stored on the consumers' own premises.

At a time when large increases in gas demand are being envisaged as desirable targets for the gas industry it should be remembered that increase in the demand for gas will, for the time being, be accompanied by a corresponding increase in the quantity of coke for sale. If the demand for gas is obtained through the displacement of coke (as in the case of space heating or water heating), then alternative equally remunerative markets for the coke must be obtained.

Finally, it must be appreciated that for some years there will be a shortage of all constructional materials for the building of gas-making plants, which places a limit on the rate of expansion of gas production.

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DISCUSSION

Dr. **J. Burns** (Gas Light and Coke Company), in opening the discussion, said: I should like to take up the authors' theme at the point where they put forward the view that the gas industry is likely to continue as a two fuel industry for some time to come. My own personal views are completely in accord with theirs, and

I think that the industry has to plan ahead now on the basis of the production of both coke and gas. The industry must, however, support to the full all the work which is being carried out now on the complete gasification of coal and the industry must be well aware of the developments which are taking place in this direction in countries other than our own.

It does appear that the reorganization which our industry is likely to undergo in the near future will call for a greater concentration of gas manufacture, and we may have the opportunity of making better use of the particular advantages of the different types of gas-making plant referred to by the authors. The industry has to meet three different types of gas load: The base load, the seasonal load, and the peak load, and it is well to examine the suitability of the types of plant enumerated by the authors for these three loads.

In any consideration of different types of plant, the primary factors to be considered are: (a) Economic efficiency, (b) working conditions for labour, and these assume greater importance in the base load plant diminishing towards peak load plants. In my view the two most satisfactory forms of base load plant are the coke ovens with associated blue water gas generators, and the vertical retort installation. Coke ovens are now highly mechanized and the working conditions in a good installation compare very favourably with the working conditions on any other form of plant. More and more domestic markets are being developed for coke and it is a fuel of high value for heating installations.

Coke Preparation

We may be required to pay greater attention to the preparation of this fuel for the market and here we may learn some lessons from our American friends who have specialized in the use of coke oven coke for domestic purposes and can obtain premium prices for this product in competition with raw coal. It is fundamental to the coke ovens that very great regard should be paid to the quality of the coal and the preparation of the coal prior to its entry into the oven.

The vertical retort installation finds favour up and down this country, and in its use in the smaller installations it has to show the flexibility which the authors describe. I think, however, that the vertical retort installation is much more efficient when it is worked under constant and unvarying conditions. It is sensitive to the type of coal fed to it and, in fact, when using certain types of coal which are admirable gas-making coals it is not really capable of wide degrees of flexibility. It has, however, the attributes of base load plant and in my opinion should be used where possible as such. There has been a very considerable improvement in the working conditions of the vertical retort installations, and although they are not so highly mechanized as the coke ovens, working conditions can be good. I suggest that the designers of vertical retort installations should receive every encouragement in the efforts they are making to improve working conditions as this is a policy which will pay sound dividends in the long run. Just as in the case of the coke ovens, there is a need to select and prepare coals for vertical retort operations.

Seasonal Load Plant

We come now to a consideration of the seasonal load plant; and the flexibility afforded by the coke oven in its use of part of the gas it produces brings it forward for consideration. The technical difficulties associated with this have been solved and the use of the coke oven for seasonal load plant becomes very largely a question of the disposal of the extra amounts of coke produced at a price to make the process economic.

The greatest degree of flexibility in any coal gas plant is to be found in the horizontal retort installations and many undertakings retain the horizontal retort system for this reason only. The system has many disadvantages. It is expensive on labour and it is very difficult to obtain working conditions which are as good as coke ovens, or on the newer vertical retort installations. I do not think that we should be satisfied with the system we have available at the present time for the production of seasonal load coal gas.

The carburetted water gas system gives perhaps the greatest degree of flexibility of any of the well-established methods of gas production. It has a degee of efficiency equivalent to that with the carbonization of coal. It is economic of labour and working conditions for men can be very good.

The economics of the process are more obscure insofar as they are dependent upon two factors: (a) The price which has to be paid for coke into the plant, and (b) the price which must be paid for oil. The supplies of oil, too, are dependent to a degree on the methods of operation used in the petroleum industry and, as we all know, fashions tend to vary rapidly in that industry, and we have to be alert to learn how to use the oil products available to us.

I would instance this by referring to the developments in America where the price of gas oil for gasification made its use almost prohibitive. The industry there learnt very rapidly how to use the cheaper heavier oils and at the same time learnt how to increase the output of gas from a given size of carburetted water gas generator. It is not unknown now to obtain a production of 9 million cu.ft. of 530 B.Th.U. gas from a generator of 9 ft. in. internal diameter in 24 hours operation.

Thus, insofar as the production of carburetted water gas is concerned, it behoves the industry to watch carefully the developments of the oil industry and to be ready to take advantage of the raw materials available to it.

Peak Load Operation

Peak load operation presents one of the greatest difficulties to the industry. Based on a study of load conditions for a period of years the maximum time the peak load plant is required to work amounts to 30 days per annum down to a minimum of two days per annum. In general, therefore, a peak load plant should be cheap in capital cost; it should be economic of labour, and above all should be accorded first-class maintenance so that it is always able to work on short notice and for this reason alone should never be tucked away out of sight in an odd corner of the works. Given these attributes the peak load plants can afford to use a more expensive raw material and efficiency is not of such prime importance as it is in the base load plant.

The ideal peak load material is probably gas of high calorific value which can be stored cheaply and diluted before distribution, but supplies are not readily available in this country. My own company is carrying out a considerable amount of work on this problem of peak load gas production using oil as a raw material. The first full scale unit is now in operation and it is hoped to be able to report on the satisfactory working of this unit in due course.

Mr. W. S. Hubbard (Liverpool Gas Company): Because of the confusing price position the authors, in preparing this perspective, have unfortunately had to confine their remarks to the statistical and technical viewpoints, and they have succeeded in producing an excellent and useful guide for those whose future activities will be concerned with production development.

Their main conclusion is that we are bound to be a two fuel industry for a long time, for the simple reason that there is no evidence that the alternative processes of complete gasification are, as yet, economical and workable on a large scale. The two fuel policy is obviously a safeguard against an unusual development in space-heating.

Two Coke Types Only

It should be expected, however, that under any national fuel scheme large-scale development of complete gasification will not be unduly delayed and its initiation will surely form some part of the many integrated systems which will be created. Generally speaking, I would also expect that due to the current abnormal circumstances, only two types of coke will ultimately be produced, namely, continuous vertical and coke oven because: (a) Replacement or extensions to existing plants in city or suburban areas by carbonizing plant with a red hot coke discharge, will or should not be allowed. The recent predominance of continuous vertical retorts over other plants is illustrated in Table 3; (b) if the industry is to make any early or effective strides to increase its gas output then large-scale plants will be essential. Thus, the ability of the coke oven to deal with mass quantities of coal with the minimum of labour, and the facility which it has to use compound firing to modify the gas output, indicates that this is the most suitable application. It would not take much imagination to see the early effectiveness of putting down a large number of these plants to a standard design. During their construction the interconnecting systems could be carried through, and it should be borne in mind that the latter work involves the employment of much unskilled labour and materials of a stereotyped nature.

Thus local replacement and the necessity for the industry to expand will produce increased quantities of continuous vertical and oven coke, and will simplify the plant contracting side. While referring to coke it is hoped that those whose job it will be to market coke will not forget that in making No. 1 coke other numbers are also made.

The improvement and development of hundreds of existing gasworks must be a source of embarrassment to contractors, particularly when it is remembered that because of the existing sites each extension is a special job, and each extension, large or small, must be equipped on modern lines; thus the original "special" becomes even more special, and the work piles up in the contractors' offices.

Linking-up means pumping costs, but these must be considered against the high costs of erecting large numbers of specially designed small plants, which in turn no doubt call for extra storage and more C.W.G. plants for peak load operation than would be required in an integrated system.

Effect of Linking-Up

The effect of linking up is well illustrated by experience in Liverpool during the past five years, where the four manufacturing stations are now operated as a single manufacturing unit, working through a central control. Compared with separate station working as formerly obtained, the requirements for gas-

making plant, storage, standby plant, spares, steam raising, boosting and maintenance, are now seen in an entirely different light, apart from the economies which have been gained by maximum base load working of the cheapest plants and reduction in man-power.

For example, the stabilizing of manufacturing conditions at the four works has meant that whereas previously each works was in need of additional steam boiler plant, now many of the then existing boilers have already been shut down and scrapped. Special reference to power requirements is made; what can be done is illustrated by the fact that last January when we were prepared to make a total of up to 45 mill. per day, a 3 mill. horticultural works, a 7 mill. continuous vertical works, and an 18 mill. works with horizontals, verticals, and C.W.G. were all operating on waste heat steam with no solid fuel boilers at work at all. The fourth station of 18 mill. per day, similar to the latter, was taking up the peak gas loads and had only two small solid fuel boilers at work. There are, in our view, tremendous economies to be made from sound integration of manufacture and main line distribution.

In their last paragraph the authors refer to the brake on expansion, owing to the material shortage. I have indicated that grouping will reduce these requirements. Could the authors indicate, for example, what steel and refractory materials would be required, say, for a 10 mill. coke oven bench against a 10 mill. continuous vertical retort bench, and, say, 10 one-million per day continuous vertical retorts?

Frequent reference is made in the paper to the facility to which the continuous vertical retort possesses for steaming. We have considerable doubts as to the advisability of the policy, believing that in attempting to do two things, that is, make coal gas and water-gas at one and the same time is an approximation in both cases, apart from the fact that the coke quality is also made variable.

Last November, after resetting, we put to work two benches of Woodall-Duckham vertical retorts at our Athol Street Works on continuous base load conditions for five years.

Not believing in the generally accepted steaming policy, and in view of the high oil costs and abnormally heavy capital costs of carbonizing plant, steaming conditions have been reduced to a point sufficient to deal only with the sensible heat in the coke, throughput increased, and the calorific value allowed to go where it will above the declared value and be straightened out by producer-gas dilution—the latter being obtained from the spare producer of this battery of settings.

Test Results

In two seven-day tests carried out before and after this charge and during which everything was carefully measured, the following results were achieved:—

(1) The throughput was increased by 18.8%, namely, from 6.26 to 7.44 tons per retort.
(2) The steam to the retorts was 27% less.
(3) Yield of coal gas per ton 6.3% less, the combined yield of coal and producer-gas was 2.8% less.
(4) The thermal output per retort per day was increased from 501 to 558, or 11.4%.
(5) The total potential output of the works increased 19% from 6.5 to 7.7 mill.
(6) The dry coke for sale increased by 11.7%.
(7) The dry fuel to producers was reduced from 9.95% to 9.35% on the dry basis.
(8) The net prime cost per therm reduced from 4.08d. to 3.61d.
(9) The overall efficiency of the works was increased from 80 to 83.

Since it is felt that this work will be of interest to others, it is proposed to publish the results in detail later.

Reference is made to the use of mechanical producers applied to continuous vertical retorts. A 3 mill. bench of West's vertical retorts at Liverpool has been in operation using hot de-dusted gas at 400° C. supplied from Power Gas mechanical machines for over five months. The mechanical producer plant is being extended and a 6 mill. bench will be in operation by the end of the year. The results are being watched with much interest and speculation. During the short term of operation it can be said from an operative point of view that the work is more congenial. Compared with the original step grate producers, which have been replaced, there is a saving in labour costs.

The coke supplied must be graded and de-dusted, otherwise the variation in gas quality and quantity are considered too wide. The economics need to be correctely analyzed since there will be quite a difference in the cost of installing mechanical producers, say, without automatic feeding, 48 hour storage and ash removal facilities. The question, too, of the size of the machine relative to particular installation needs careful consideration. The machines should be installed on a graded basis in order to deal with variation in the numbers of beds of retorts in operation.

Finally, it is unfortunate, having presented us with such a fine paper, to arrive at the last paragraph and find that although it would be nice to do many of the things mentioned in the paper, it simply cannot be done, or can it?

Anticipated Decrease in Coke Demand

Mr. **H. S. Cheetham** (Humphreys & Glasgow, Ltd.): Under the heading "The Coke Gas Ratio" the authors state that while there is general confidence that the demand for gas will continue to increase, the question as to whether the demand for coke will similarly increase is a matter for argument.

As one who is concerned mainly with the building of plant for the gas industry, I cannot claim any personal knowledge of these matters, but I have obtained the views of some of my friends who are directly concerned with gas and coke production. They tell me that while they have no doubt about the increasing demand for gas, they rather anticipate a decreasing demand for coke. Furthermore, they tell me that while the gas consumer may have the foresight to possess himself of a store of solid fuel, he will use it only if and when gas ceases to come through the tap. I have learned another thing concerning the load factor. I understand that the load factor is getting worse and that with the availability of more gas-fired central heating equipment it is expected to worsen at an increasing rate.

Consideration of these trends in consumer demand for gas and coke gives food for thought as to how the manufacturers of gas and coke are to meet the situation. It seems that the essentials of the plant of the future are that it shall make more gas and less coke per ton of coal carbonized and that it shall have greater flexibility to meet wider variations in gas consumption.

The authors have given a very useful summary of the ways in which a limited flexibility of output of the various types of carbonizing plant may be obtained, and it is well established that with the use of auxiliary carburetted water gas plant, the gas industry can meet the increasing demand for gas accompanied by a decreasing demand for coke. This is illustrated very clearly by examination of the annual returns for the gas industry published by the Ministry of Fuel and Power. In particular I refer to the figures for 1938 and 1946. In 1938 the total coal carbonized was 18,469,000 tons. In 1946 it was 21,824,000 tons, an increase of 18%. In 1938 the total coke gasified was 535,000 tons. In 1946 it was 1,375,000 tons, an increase of 157%. If now the 1938 results are adjusted to the 1946 output conditions, it follows that the gasification of 665,000 tons of coke and 334,000 tons of gas oil would have displaced 2,876,000 tons of coal.

As the authors point out, gas oil has to be imported, but I should have thought that the availability in the case I have mentioned of 2,876,000 tons of coal would be a factor of importance in considering whether or not we can afford to import 334,000 tons of gas oil or other petroleum products which may perhaps be substituted for gas oil at a not too distant date. Trials have been carried out using other by-products.

This exchange of coal for gas oil is not, however, the whole story, for the use of gas oil and coke in the manufacture of carburetted water gas not only replaces some of the coal gas, but it provides peak load gas for the production of which coal gas plant is entirely unsuited. Even with gas oil at its present high price, carburetted water gas can to-day be made at a price substantially lower than that of peak load coal gas. Furthermore, carburetted water gas plant is vastly cheaper to construct and utilizes far less engineering materials than is the case with coal gas plant.

In conclusion I would refer briefly to the new processes of gas production of which the authors have given us an outline. All will agree that continued research and investigation is of the first importance to our industry, but it is in my view prudent to keep before us the fact that so far as we can see at present the new processes which are being tried and which are envisaged are likely to be much less flexible than present carbonizing plant. We have, therefore, the situation of decreasing flexibility in coal gas production with a future consumer demand for gas varying more widely than ever before. Thus the production of peak load gas at lower cost is of ever increasing importance.

Indiscriminate Use of Methods

Mr. **M. Sinclair Gaskill** (West's Gas Improvement Co., Ltd.): The authors have presented in a concise form much factual information which should prove of great value in the general survey of the industry which must soon be undertaken. The gas industry is rich in the number of alternative methods at its disposal, but it is suggested that these methods are used too indiscriminately, resulting in too great a degree of variation in qualities of gas and coke offered for sale within areas which are at once too small and too closely contiguous to tolerate such variations. There may be within one urban area, where people move freely about, working in one district and living in another, two or three different declared calorific values and coke of two or three different densities. Is not it almost as important to have "a uniform scheme of attaining the declared calorific value" over each urban concentration as that such a scheme "should be adopted at any one works," as stated in the paper?

The public will never agree that gas-making is as highly developed as electricity generation until there is far greater

uniformity in the properties of gas, and coke, and perhaps even in the price, at least over areas in which people live close enough to compare notes. There is, of course, no justification for the large number of declared values which have been used. The three mentioned, with perhaps another one, lower, for Scotland, are quite sufficient.

The authors have disclaimed the desire to prophesy, but if it is permissible to extend the definition of perspective to the interrelation between the present and the future, then they have presented a paper which gives a very clear picture of the present position of the industry and a sound basis for a consideration of its future.

It is to be hoped that the importance of the future development of the industry in relation to the whole structure of national economy will be more fully realized by the general public, since it is impossible to over-estimate the importance of the efficient use of our coal resources.

It is feared that the time has not yet arrived when the large amount of coal at present wastefully used will be processed, and the gas industry could not, of course, deal with such a vast quantity; but it is not, perhaps, too much to hope that a nationalized fuel industry will be so ordered that the gas industry may make the most efficient use of coal in the equipment at present available.

Choice of Suitable Coals

As pointed out in the paper, while modern plant will carbonize almost any type of coal the choice of suitable coals will in all cases result in increased efficiency. From Table 1, however, it is apparent that geographical position exercises, probably, a greater influence on coal supplies than their gas-making quality or suitability in other respects. Obviously cost of transmission is involved in this question, but this would be offset to a marked extent if the handling of inert material could be minimized by a reduction in the ash content of the coal.

As the authors point out, the economies of the gas industry have depended on its development as a two-fuel industry. While it is considered that complete gasification would be preferable, there is no doubt that for many years the gas industry will be a large producer of solid fuel. In this respect, also, low ash content of coal is a necessity. As mentioned in the paper, correct sizing of coke is most important, but much could be done to produce coke suitable for varying purposes by coal blending. This procedure, while widely practised in the coking industry, is now receiving attention in the gas industry, but again involves the supply of suitable coals in regulated proportions.

The authors insist on the fact that good coke is decisively governed by good coal, but it is a pity that this point was missed in an earlier passage which, it is suggested, should read: "Such coals must themselves have a low ash content as well as volatile content. . . ." It is very necessary that the gas industry should insist that coal cleaning should be done at the colliery.

While on the subject of coal quality, the relationship of this factor to the question of refractories should be considered. The demand for refractories in the gas and other industries at present exceeds the supply, and while, as far as I am aware, no definite information is available on this country's resources in the raw materials for refractory manufacture, such resources as can be economically utilized are not unlimited. Mr. A. T. Green, of the British Refractories Research Association, has recently pointed out the necessity to avoid undue damage to refractory material in the operation of carbonizing plant. It is difficult, however, to avoid such damage when installations have to be forced to obtain the required output from inferior coal, or where the ash in such coals is liable to attack refractory materials.

In the section entitled "Aspects of Gas Production," the authors rightly place fuel economy first, and in this connexion a further extract from Dr. Pexton's paper relative to continuous vertical retorts is worth noting, namely, "although the overall fuel economy is so favourable, this system probably offers the greatest scope for further improvement."

Flexibility of Output

Flexibility of output is an important factor in gas production, but the economics of some of the methods outlined are considered rather doubtful. It is curious that almost every means of obtaining flexibility in other types of plant can also be applied to the continuous vertical retort, with the addition of its unique ability to slow down and increase production in the individual retort. Development of the enclosed intermittent vertical retort has probably been checked by war and post-war conditions. Certainly this appears to be the only type of plant in which the characteristics of the intermittent vertical can be combined with the amenities and economies of the continuous vertical retort.

In the section of the paper dealing with future possibilities, the authors mention the question of new centralized works. The maximum size of such works to ensure the greatest efficiency is a debatable point, and it would be valuable to know the authors' views on this question. In this connexion, the statement is made that "for the largest base-load plants one may expect an increase in the use of coke ovens." At first sight this statement would not appear to be justified by much of the information given in the paper, and the authors' reasons for this opinion would be of interest.

To summarize, it is considered that gas-making plant should be designed and operated for the most effective and efficient production of gas. Coke is a residual of the very first importance, which should be prepared for the market with the utmost care, but it should be kept firmly in its place as a by-product. In conclusion, I should like to thank the authors for a very valuable contribution.

Dilution of Coal Gas

Mr. **S. K. Hawthorn** (Birmingham): This paper is a most valuable one on the gas production side of the industry. Sections II, III, and IV are extremely useful as an historical survey of the development of the industry, and the trend of carbonizing methods up to the present time. Many of the figures given have not previously been available and the analyses of the distribution of gas coals from various fields and the distribution of various types of carbonizing plant according to size of undertaking are very illuminating. Sections V, VI, and VII offer very considerable scope for discussion, but I wish to refer particularly to carbonization in continuous vertical retorts and to comment on the subject of dilution of coal gas. The authors have made it clear that more than half the coal gas made in this country is produced in continuous vertical retorts and probably this proportion is increasing year by year.

The reasons for the popularity of this type of carbonizing plant are undoubtedly the smooth continuity of the process, coupled with good working conditions and the discharge of cool coke of free burning quality. On the score of thermal yield of straight coal gas per ton, however, the static systems of carbonizing are still well ahead. Continuous vertical retorts produce a mixture of coal gas and blue water gas—in fact they cannot produce straight coal gas alone as it is a necessary feature of their design and working to quench the coke internally, thereby producing water gas. The thermal production of straight coal gas in a continuous vertical retort is therefore masked by blue water gas addition, but it is a fact that, for the same final calorific value, the yield from static carbonizing plus outside blue water gas is up to several therms per ton greater than the mixed gas from continuous vertical retorts.

I do not agree with the authors' statement that the output of therms per retort per day from a particular coal remains constant over quite a wide range of calorific values. The quantity of heat required to produce a therm of coal gas is very much less than the quantity of heat required to produce a therm of water gas and as only a certain limited quantity of heat can be transferred in unit time through the walls of a retort, that heat can produce more coal gas than water gas. It is, of course, well known that if the calorific value is to be lowered by additional steaming, then the coal throughput must be reduced.

Where maximum therms per retort per day is the target, it is profitable to steam only to the extent necessary to utilize the residual heat in the coke and it is on these conditions of "slight steaming" that the authors' figures of fuel consumption in Table 5 are based. Steaming beyond this point involves a reduction in throughput and inefficient production of blue water gas by external heating and a reduction in the maximum capabilities of the retort measured in therms per retort per day and, of course, a progressively rising fuel consumption per ton of coal. I am convinced too, that as the throughput of a continuous vertical retort is reduced to enable increased steaming, the yield of straight coal gas per ton is reduced, although this effect tends to be hidden by the higher volumetric yield per ton at the lower calorific value. The reason for this reduction in straight coal gas yield is the slower heating of the charge due to its slower travel and a greater proportion of condensible low temperature products—in short, less gas, more tar.

Highest Yield from Continuous Verticals

I, therefore, believe that continuous vertical retorts will give the highest yield in therms per retort per day, while working at maximum throughput and with slight steaming only. When operating on difficult coals higher throughputs often lead to smoother working. The factor of maximum production from a given plant is vital where shortage of plant exists and with the ever increasing demand for gas and the long delays in installation of new plant, many undertakings must give first consideration to securing the maximum thermal yield from the plant they have available.

This argument suggests that, with average coals, continuous vertical retorts should not be called upon to produce gas of a lower calorific value than, say, about 480 B.Th.U. This calorific value may be reduced by benzole washing or by the addition of an outside diluent, but if such facilities are absent the maximum production of gas and the fullest use of capital outlay will be attained by declaring a calorific value not lower than about 480 B.Th.U.

Flexibility of output is discussed, and it is pointed out that con-

siderable flexibility is available on both continuous and intermittent systems. But this factor only, or mainly, concerns the small works and many of those of medium size. The large works, possessing carburetted water gas plants, use their coal gas plant as base load and get the best advantage by operating the working plant at all times at full capacity and shutting down sections for repairs or standing cold in accordance with normal seasonal variations in demand. The carburetted water gas plant is then used for making up day to day shortages between coal gas make and district consumption. Carburetted water gas used in excess of peak load requirements or used continuously as a diluent becomes base load and as such is usually more expensive per therm than coal gas.

Dilution

The authors refer to dilution and point to the greater constancy of combustion characteristics when producer gas or blue water gas are mixed with coal gas, compared with carburetted water gas addition. In works of moderate or large size, a good case may be made for diluting coal gas with blue water gas or producer gas made in separate plants to augment continuously the base load plant. Blue water gas, as a diluent, has the merit of low inerts, moderate specific gravity and a reasonably high calorific value of about 290 B.Th.U. The consumption of substantial quantities of high grade coke may or may not be an advantage according to circumstances. The thermal efficiency of production, however, is only about 65%, and the flexibility of production is limited. A holder of substantial capacity is required to balance the intermittent make and to give the necessary flexibility for varying the volume of diluent required to maintain constant calorific value of the mixed gas. There is much to recommend producer gas as a diluent, especially if it is generated independently in a mechanical producer. The independent mechanical producer is simple and relatively inexpensive compared with blue water gas plant—it operates at a higher thermal efficiency, is extremely flexible in output between 30% and 100% full load and can operate on the smaller sizes of coke or on non-caking coal. The calorific value of the gas is about 130 using coke or 160 using non-caking coal.

In Birmingham where the coal gas plant consists almost entirely of continuous vertical retorts, we have been producing gas of about 480 B.Th.U. calorific value, and reducing this to the declared calorific value of 450 by extraction of benzole. We are now installing four mechanical producers, three for non-caking coal and one for coke, with a combined capacity of about 10 mill. cu.ft. per day, and as soon as these are available we intend to cease benzole extraction and operate the continuous vertical retorts at maximum throughput and maximum calorific value (probably about 490) steaming only sufficiently for adequate coke cooling. Dilution with producer gas to the present declared calorific value of 450 will enable us to augment the capacity of our coal gas plant by 15% or 16%. The producer gas will be cleaned and partially cooled to 70°C. before admission under automatic control to the foul mains. The effect on combustion characteristics is not expected to be adverse and the distribution system will not be overloaded by the slightly higher specific gravity.

In addition to the enhanced productive capacity of the works for a relatively small expenditure, two other advantages will accrue:—

(1) Part of the carburetted water gas plant which has had to be used as base load plant will revert to its true function as peak plant with a substantial saving in the use of imported gas oil. The producer gas will be considerably cheaper per therm than the carburetted water gas it serves to displace.

(2) The extreme flexibility of producer gas production will allow control of admixture to maintain a straight line calorific value of the mixed gas without the day to day alterations of throughput and steaming which are inevitable to maintain constant calorific value when carbonizing mixed coals of considerable variety in continuous vertical retorts. Frequent variations in extractor speeds and in steaming for the purpose of calorific value control are not conducive to maximum efficiency.

In the final sentence the authors point out very pertinently that for some years the shortage of constructional materials will limit the rate of expansion of gas production. I suggest that in appropriate cases and particularly on large works, the installation of mechanical producers in fairly short time and with the minimum expenditure in materials per therm of gas made, may be, at least temporarily, a solution or alleviation of the problem of gas making plant shortages. This scheme may be even more attractive on large works where the carbonizing plant consists of horizontals, intermittent verticals or coke ovens. There is very much more that invites comment in this very intriguing paper and I would like to congratulate the authors on an outstanding contribution.

Aims of New Processes

Dr. F. J. Dent: The clarity with which the authors have been able to review the several gas production methods which have been designed to suit a wide variety of localities, coals and sizes of undertaking gives a vivid impression of the high degree of development which has been attained. It makes one realize that the introduction of any radical change in basic processes will take some time, and the authors' account of future possibilities of gas production is in keeping with this view.

Their treatment in this section leads to conclusions which, qualified as referring to the immediate future, would be very difficult to question. With respect to new processes, it describes what the aim should be, what has been achieved, and the obstacles that still lie ahead. These obstacles should be appreciated, and, as one concerned with investigations into them, I should like to review the stage which has been reached.

In considering the investigations being undertaken both by the Gas Research Board and by others it is, I think, of the utmost importance to be clear regarding the different problems which they concern.

First, there is the peak load problem; and, although a description of the flexibility of carbonizing plant is a feature of the paper, this problem is nevertheless with us to the extent of justifying the use of relatively high-priced imported oil in carburetted water gas plants.

Secondly, there is the problem of controlling coke production according to fluctuations in the coke market such as we have known in the past.

Thirdly, there is the problem which might arise if there was a more serious deterioration in the coke market, due, for example, either to a rapid expansion in the use of gas or to an improvement in coal-burning appliances.

Fourthly, there is the problem of producing an appreciably cheaper gas, so that it can be an attractive alternative to solid fuel for general heating purposes.

The first, two, relating to peak loads and a moderate control of coke production, can be considered together, particularly since present practice is usually to deal with them by the same auxiliary process, the carburetted water gas process. It may be pointed out that this union of functions appears to have limitations, since there is the Gas Research Board developing methane synthesis with the view that a raw material such as oil should not be used for controlling coke production, while the paper which we had in April from Dr. MacCormac, of the Gas Light and Coke Company, is an indication that for the sharpest peak loads it is an embarrassment to have the utilization of oil saddled with the fixed charges associated with blue gas production.

Controlling Coke Stocks

From the point of view of the Gas Research Board, I should like to make one point clear. Methanization of blue water gas is not to be regarded as an immediate competition with oil for peak load gas. So long as oil is available at a reasonable cost, one cannot sacrifice, on peak load, the increase in thermal output which is obtained by its use. This does not apply, however, to off peak load, and, if the water gas plant is used then, it is mainly with a view to controlling coke stocks. The aim should be to do this with a minimum cost in raw materials.

In comparing methanization with oil enrichment for this purpose, it should be realized that methanization gives a more effective control over the amount of coke for sale in so far as the production of a given volume of methanized water gas involves the gasification of considerably more coke than the production of the same volume of carburetted water gas. While this fact makes methane synthesis especially advantageous for controlling surplus coke during the summer months, in making comparison with oil the net cost of raw materials for given outputs of mixed gas and coke for sale from a whole works should be considered. On this basis it is estimated that there will be a differential in favour of methanized gas which will be more than sufficient to pay for the synthesis plant and catalyst, carbon dioxide removal, and organic sulphur removal. In other words, if we are successful in the tests on methane synthesis and blast pre-heating for which preparations are now being made, we believe that there will be at once an economic process capable of materially reducing our dependence upon imported oil. Thus, in the work being carried out both by the Gas Research Board and by others it can be said that substantial progress is being made towards the solution of the problems associated with peak loads and the moderate control of coke production.

For the more extensive control of coke production visualized by the third problem, we want a gasification process which will produce a high calorific value gas as cheaply as that now obtained from carbonization. We want, in fact, an alternative base load process. It seems unwise to consider a process using oil for this purpose, and, while methanized blue water gas will compete with carburetted water gas as an auxiliary off peak load, it will be dearer than coal gas.

Direct Gasification Under Pressure

The most promising solution appears to be the direct gasification of coal under pressure; and although, as the paper points out, there are technical difficulties to overcome, this process appears capable of meeting requirements if arrangements are made for its operation in large units. Research is therefore proceeding on these lines, but it is too early to speak of full-scale plant design.

RECENT BY-PRODUCT PLANT INSTALLATIONS AT STOKE-ON-TRENT

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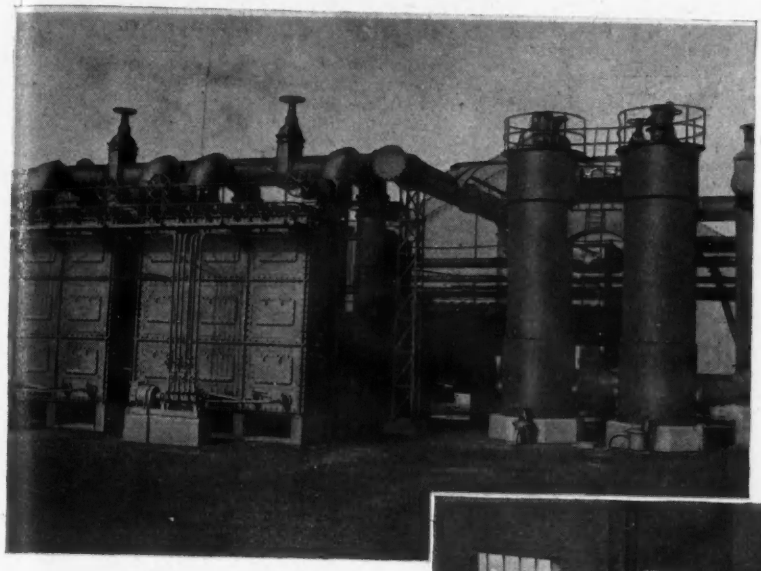

Multifilm Ammonia Washers
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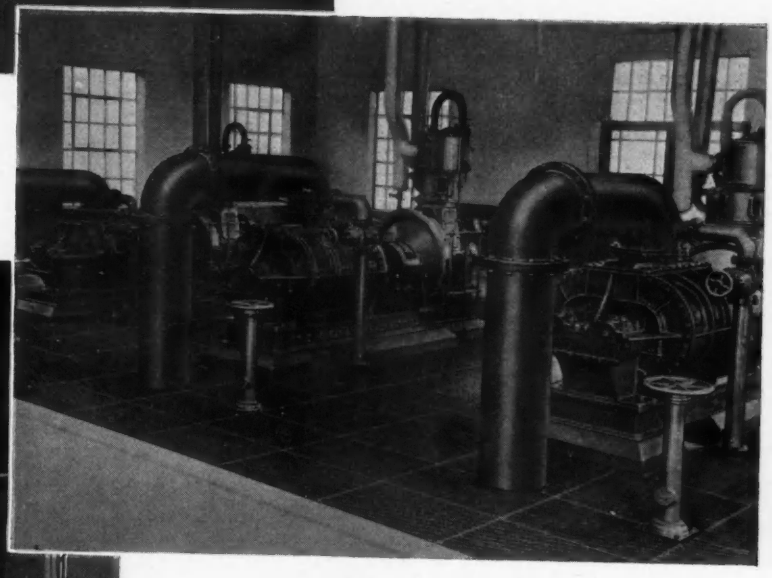

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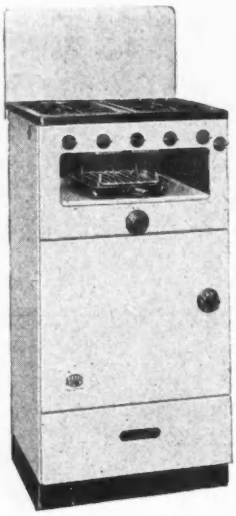


No. 177 with short splashplate ; 4 burner hotplate ; 14" oven ; plinth base ; finished in cream/black.

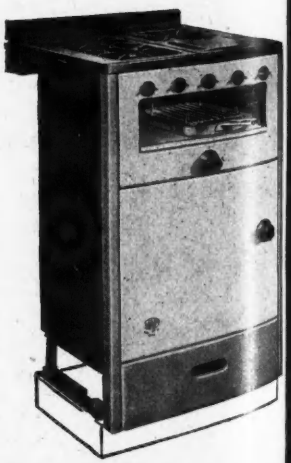
CHOICE OF OVEN HEIGHTS: 14" or 16"

No. 177 with short splashplate ; 3 burner hotplate ; 14" oven ; plinth base ; finished in dapple/white.

No. 177 with plate-rack and splashplate ; 3 burner hotplate ; 14" oven ; chromium runners ; finished in cream.

No. 177P (Portal type) ; 3 burner hotplate ; 14" oven; finished in green/cream.

NOTE : Supplied only with 3 burner hotplate and 14" oven.



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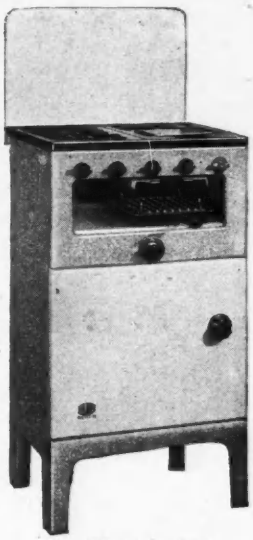
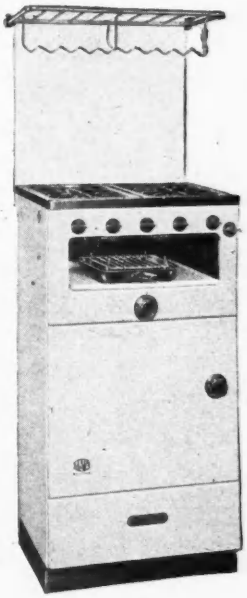
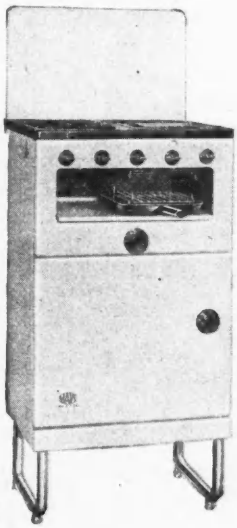


No. 177 with short splashplate; 3 burner hotplate ; 14″ oven ; cast iron legs ; finished in dapple/white.

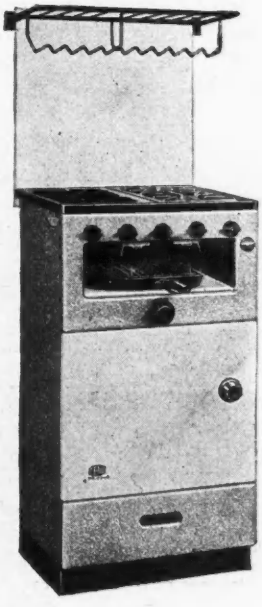


No. 177 with plate-rack and splashplate ; 4 burner hotplate ; 14″ oven ; plinth base ; finished in cream/black.

No. 177 with short splashplate ; 3 burner hotplate ; 14″ oven ; chromium runners ; finished in cream.



No. 177 with platerack and splashplate ; 4 burner hotplate ; 14″ oven ; plinth base ; finished in dapple/white.



No. 177 (Build-in-type); 3 burner hotplate ; 14″ oven ; plinth base ; finished in cream with black base.

NOTE : Supplied only with 3 burner hotplate.

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It is the fourth problem, relating to the production of a low-priced gas for general heating, which raises the most speculation, and it is with some disappointment that we recognize that, while pressure gasification can be considered as a potential guarantee against any serious coke problem, there are no indications yet that its adoption would lead directly to a material reduction in the cost of gas manufacture, especially if one takes into account the poor load factor associated with general heating.

Contemplation of this fact suggests that, while the volatile matter in coal is an inherent source of rich gas, economical to distribute, there is no known process which liberates the gas in a manner which can be regarded as completely satisfactory, having in mind the small amount of heat theoretically required. As a result, if gas is to be of really low price it must not bear the brunt of process costs, and in carbonization the cheap gas will be obtained only if we can increase and maintain the return from coke, while with gasification processes it appears necessary to incorporate oil synthesis. I should welcome the authors' observations on these possibilities. It may well be that if the work on oil synthesis now going forward in America achieves the results which have been forecast, the incorporation of off-peak synthesis in gas manufacture would bring material benefits. The gains would, however, be greater if coal were gasified to as to produce both gas and oil as major products; but perhaps the cheapest gas of all would arise if it were obtained as a by-product from a much larger oil synthesis scheme. Then the space-heating load of which we are at present apprehensive might be readily accommodated.

With research workers making an almost world-wide onslaught on the problem of the utilization and processing of coal, it is difficult to escape the belief that, sooner or later, high calorific gas will be available in large quantities; but these possible developments, being clearly in the long-term class so far as their application is concerned, are in no way at variance with the conclusions regarding the relative positions of gas and coke which have been reached in this admirable survey by the authors. Much technical work remains to be done before such developments can be translated into practice, and it is unlikely that they will affect the general conduct of gas manufacture in the next few years. It does appear, however, that the centralization of gas production, by whatever process, would be a step in the right direction.

Two Allied Problems

Mr. **E. O. Rose** (Tottenham): The authors have devoted considerable time to the two allied problems of flexibility of output and flexibility of the gas/coke ratio. It is with these problems, above all others, that we shall have to wrestle during the years ahead.

A considerable study has already been made of the load-producing effects of various types of appliance and of changes in weather conditions. Although the last word on these subjects has not yet been said, it is apparent to all who have given the matter thought that any wide extension of the use of completely gas-fired plant for warming purposes will bring variations in load unprecedented in magnitude and uneconomic by our present way of reckoning. In the past, a cheap and plentiful supply of gas oil has been our mainstay in meeting load variations, yet even with this asset at our command the prospect of the plant that would have had to lie idle for so many months of each year was not one which we were ready to face with equanimity. How much worse is our predicament now, when the Minister of Fuel and Power has informed us that the minimum use of oil in this country must be regarded as a long-term policy!

This, we understand, is dictated not merely by the dollar shortage but by a world scarcity of oil. The internal combustion engine, dependent upon liquid fuel in one form or another, is the only available prime mover for aircraft and road transport. Liquid fuel also is the only fuel suited for Naval purposes. It stands to reason, therefore, that the use of oil in static installations of any kind is to be strongly discouraged.

The authors have referred to new processes of production now being investigated by the Gas Research Board: the enrichment of blue water gas by methane synthesis and the application of the Lurgi process to British coals. It is possible that these processes may bring the solution of our problems of flexibility. The pursuit of these investigations should be given more general support than is at present evident.

In this connexion, I should like to call attention to a paper read by Dr. Dent at the Oxygen Conference. In this he explored the possibility of combining a process of complete gasification with the production of synthesis gas and Fischer oil. By such a process gas plant would be used during the summer months for the production of a valuable oil product. This paper deserves wider publicity within the gas industry.

It is significant that the U.S.A. are spending immense sums on the development of plant for production of synthetic gases and oils from coal. If this is necessary in what has always been regarded as the home of natural oil, how much more in need of such processes are we in this country!

Interim Policy

However fast we move, we cannot expect the commercial development of any of these new processes for several years to come. What is to be our policy in the interim? Two things are apparent. First, the policy outlined in the Simon Report should be as far as possible implemented. The Government, acting through the three nationalized fuel industries and the Ministry of Health, can be the only body to set this in motion. This is the only way to keep the gas/coke ratio and the incidence of gas and electrical peak loads within control. Secondly, as we are to operate with the minimum use of gas oil, our immediate efforts should be directed to operating our carbonizing plants at the required degree of flexibility and with the greatest possible thermal and labour efficiency at all loads.

The fuel expended on heating retorts and the labour required to man an installation can be regarded almost as fixed standing charges, independent of coal throughput. It is obvious, then, that if these charges are kept to a minimum the operational efficiency at low loads is improved.

Finally, I congratulate the authors on their success in placing before us such a concise and reasoned summary of our methods of gas production.

The **President** apologised to those other members who had desired to speak, but who could not be called on for lack of time.

A VISIT TO FLAVEL'S WORKS

On May 28 a party of Home Service Advisers of the United Kingdom Gas Corporation visited Eagle Foundry, the works of Sidney Flavel & Co., Ltd., at Leamington Spa. The main party, accompanied by their Chairman, Miss E. R. Ashton, of the Stretford and District Gas Board, and Secretary, Miss H. Swindells, of Manchester, travelled by motor coach from Manchester, and were joined at Leamington by members from Yorkshire and Bedford.

Lunch was served at the Bath Hotel, where in a brief address of welcome, Mr. W. Arnold Jackson, Chairman and Managing Director, expressed his pleasure in having the opportunity to show the ladies how Flavel gas appliances are manufactured. The Home Service Advisers of the gas industry, in their close contact with the domestic consumer, could help manufacturers immensely by passing on points of constructive criticism, remarked Mr. Jackson, and he would welcome any such observations they cared to make.

Home service advisers of the United Kingdom Gas Corporation at the Leamington Spa works of Sidney Flavel & Co., Ltd.

Colonel W. M. Carr (Chairman of the United Kingdom Gas Corporation) sent his appreciation of the arrangements made for the visit, and in a letter read to the assembled company Mr. J. W. Rodgers (Sales Superintendent, United Kingdom Gas Corporation) conveyed his good wishes for a successful day and expressed disappointment at his inability to be present.

At the works the party divided into groups, and under the direction of guides were conducted through the shops to inspect the various stages of gas cooker manufacture at close quarters. Great interest was displayed in the fine new laboratory, where cookers were being tested and technical research carried on. Actual samples of dishes cooked were subjected to critical inspection. The tour completed, tea was served to the guests and a pleasant hour was spent in general conversation and examination of finished products.

Miss Swindells voiced the thanks of the party for an enjoyable day and instructive visit, and Miss Ashton seconded the vote of thanks.

Mr. W. A. Jackson replied on behalf of the Company, and was supported in his remarks by Mr. Jack Allen (Works Director) and Mr. F. M. Rogers (Sales Manager).

The Society of Chemical Industry will hold its 67th Annual General Meeting in Edinburgh from July 12-17. On July 13, Sir John Anderson, the Messel Medallist, will give an address, entitled "Science in Relation to the Public Services." The programme includes visits to works, and other excursions.

News in Brief

Nottingham Was the Venue for the annual staff outing of the City of Coventry Gas Department on June 4. Together with Mr. and Mrs. Wakeford the party numbered 36, and foregathered for lunch, tea, and theatre, the rest of the time being taken up with individual pursuits.

Among Stoves, Open Fires, and Cookers on a new list of additions to the range of solid fuel appliances recommended to local authorities by the Ministry of Health is Newton No. 1, of Newton Chambers & Co., Ltd., an openable stove with back boiler, of the continuous burning inset type. Hitherto the Newton had been only provisionally included.

In the Bois-le-Dame Colliery, near Liege (Belgium), an experiment in underground gasification has given satisfactory results. French mining interests have asked to be associated with the enterprise, and an agreement has been signed in Brussels providing for French participation in the cost of the research to the extent of 50 million Belgian francs (about £280,000).

The Newcastle-upon-Tyne Exhibition illustrating the trend of design and technical advancement in post-war domestic gas appliances, to which brief reference was made in the "JOURNAL" last week, has proved so attractive that it will remain open until June 26. An extended notice of the exhibition is reserved for publication in "GAS SERVICE."

The Workpeople and Staff of the Coventry factory of George Wilson Gas Meters, Ltd., had their annual outing on June 5, London being the venue. Lunch was arranged for the whole party, and afterwards many took the opportunity of going up the river and visiting Kew Gardens, while others devoted their time to general sightseeing. In the evening the theatre was a popular rendezvous, and a return to Coventry was made in three reserved coaches on the midnight train.

In Reply to a Claim on behalf of 250 employees of Cork Gas Consumers' Company for an increase of 11s. weekly, in accordance with the recent formula of the Eire Labour Court, the Company's representatives, at a Labour Court sitting in Cork, made the case that subsequent to the Labour Court award of 1947, and the recent strike, increases had been given in excess of the award, and those should be offset against the 11s. now demanded. The Court will announce its decision in due course.

Two Councils Have Been Appointed to advise the organizers of the Festival of Britain, 1951, on the arrangements for the exhibition of science and technology, and on the contribution to the festival to be made by architecture, town planning, and building research. The members of the Council for the Exhibition of Science and Technology are: Sir Alan Barlow (Chairman), Sir Wallace Akers, Sir Stanley Angwin, Sir Edward Appleton, Sir Alfred Egerton, Sir John Fryer, Sir William Halcrow, Sir Edward Mellanby, Professor Andrew Robertson, Sir Edward Salisbury, and Sir Frank Smith. The Secretary is Mr. Ian Cox.

Wishaw Town Council has approved a decision to purchase materials now—anticipating a rise in price—for a scheme which will not go into operation until 1951. At the last meeting of the Corporation approval was given to the resetting of four 50 in. retorts by Wests Gas Improvement Co., Ltd., Manchester. A section of the Council attempted to refer back the matter on the basis that the work could not proceed until a date by which the industry would have been nationalized. It was argued that any improvement of such a delayed nature should not be attempted. Against this is was argued that any charge falling on the undertaking at the present time would be returned if nationalization took place. It was also stressed that the Burgh was under an obligation to meet its commitments to its consumers. They had to keep plant up to date and when the Government did take over their obligations would be adequately compensated. It was indicated by the Town Clerk that the Gas Manager anticipated a considerable rise in cost and was advocating the present policy to meet this situation.

The Most Valuable Order ever placed by Finland with a foreign firm has been received by Simon-Carves, Ltd., of Cheadle Heath, Stockport. with whom the Helsinki Corporation Gas-works have signed a contract for coke ovens, gas producer plant, and ancillary equipment worth over £650,000 to provide gas for the city and to replace the present plant. More than £420,000 of this sum will be expended on British materials and services. The contract comprises a battery of 22 Simon-Carves entire underjet coke ovens to carbonize 300 tons of coal per day, and Simon-Carves mechanical gas producer plant. The ovens will be complete with oven machines, coal service bunker, and coke quenching plant. The contract also includes coal handling plant of 60 tons per hour capacity to take coal from stock and deliver it, crushed and blended, to a storage bunker, and coke handling plant of 40 tons per hour capacity to convey, grade, and bunker the coke for sale. Simon-Carves, Ltd., have undertaken to design, erect, and start the plant in time for the winter load of 1951-52.

Demand for Technical Training in Scotland has reached a peak and there are prospects that educational facilities will not be equal to the demand this coming winter. The Royal Technical College, Glasgow, has already indicated that it will restrict the number of day students accepted because of pressure of other work and the considerable demand for entry.

The Chairman of the Directors of the Stamford Gas Company (Mr. H. E. Dalton) on June 5 turned the valve admitting gas for the first time into the new gasholder which has been erected at the Company's works. The holder replaces one of an obsolete type, and work on its construction was commenced about six months ago. Of 130,000 cu.ft. capacity, it was erected by Messrs. R. Dempster & Sons, of Elland, Yorks, with Mr. E. Dyson as foreman fitter.

Among the Exhibits in the new heavy industry section of the Engineering Centre, Glasgow, opened recently is a display by the Hillside Foundry and Engineering Co. (Coupar), Ltd., a Company associated with the Henry Balfour Group. This plant is concerned with the production of static washers, purifiers, water tube condensers, &c. Other plant on show is by Cochran of Annan, Babcock and Wilcox, Ltd., the British Train Co., Ltd., Matthew Hall & Co., Ltd., Clyde Fuel Systems, and Fibreglass, Ltd.

A Series of Gas Industry Films have been shown in the senior schools of the North Divisional Executive Area of the Leicester Education Committee, by the co-operation of the Executive Committee and the Loughborough Gas Department. Schools were visited in Castle Donington, Shepshed, Quorn, Barrow-upon-Soar, Mountsorrel, and Loughborough, and some 1,600 senior scholars attended the showings. Special shows of the latest "Transference of Heat" films were given to audiences of teachers, and the whole visit has been much appreciated by the Education Authorities.

The Use of Toughened Glass for street lamps was demonstrated recently in Glasgow by Pilkington Bros. The show concentrated on industrial uses of armour plate and toughened glass and a series of displays were featured to demonstrate the virtues of the material. According to the manufacturers, toughened glass has a considerable potential field in street lighting, where the element of loss has been a serious matter both in terms of cash and replacement for some years. Although initial costs are heavier the undertaking installing toughened glass will more than recover that cost through a longer life.

Penny Slot Meters are disappearing at Glasgow. They are not being put into the new housing schemes. Tenants there must take the 1s. meter. About 5,000, however, are still in use in the city, compared with 175,000 1s. meters. In the past year the Gas Department has been steadily pushing out the penny meter. It was found that collectors, clearing penny meters in the outskirts of the city, had too heavy a weight to carry. The price of gas has gone up and the supply that can be got for coppers is small. So, when replacements of penny meters are needed, and in housing schemes, the Department is putting in the 1s. meter.

Viscount Hyndley and other representatives of the National Coal Board recently met representatives of the Chamber of Coal Traders and the Co-operative Union, Ltd., for preliminary discussions on the relationship between the Board and the wholesale and retail coal distributive trade and the steps required to be taken to make coal distribution as efficient as possible. The representatives of the distributive trade agreed to co-operate fully with the Board in tackling the many different problems. It was decided to set up joint working parties of experts from both sides to deal urgently with specific aspects of the problems involved—such as channels of supply, price structure, conditions of sale, quality, short weight, mechanization and modernization of depots, &c.

Worsening of the Weather in Scotland has had hardly any appreciable effect on throughputs at gas-works, which are finding no difficulty in meeting the extra demand for gas for heating and lighting. Supplies of coal up to full programmed tonnages are arriving regularly at the various works, and stocks are building up satisfactorily. Deliveries of deep-mine gas coal from Durham and Northumberland to Scotland have now ceased. The whole of the output from these areas has been programmed out of Scotland, part of the former Scottish tonnage now going for export, while a bigger tonnage than hitherto is being directed to London. A small quantity of Northumberland open-cast coal is arriving at Glasgow, but this is not expected to continue for more than a limited time. Particularly careful steps are taken during the extraction of this coal to ensure maximum cleanliness, with the result that the quality is exceptionally good. The number of benches in operation at the gas-works has been reduced for the usual summer overhaul of plant, and the tonnage of coal carbonized has fallen by some 21%, which, it is expected, will be reduced a further 7% during the period of minimum throughputs.

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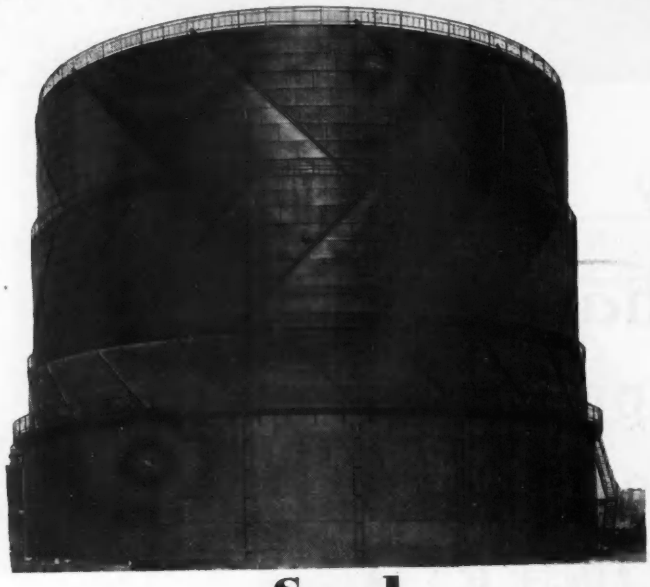

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Personal

Mr. R. D. BRIGGS, of Edenbridge, Kent, has been appointed Assistant Gas Manager of the Dumfries Gas Department.

* * *

The Birthday Honours announced on Thursday included Knighthoods for Mr. GEOFFREY HEYWORTH, Chairman of Lever Brothers and Unilever, Ltd., whose name became famous in the gas industry as Chairman of the Committee of Enquiry into the Gas Industry, which reported in favour of regionalization three years ago; and for Mr. HAROLD E. G. WEST, Managing Director of the Newton Chambers Companies. The C.B.E. was conferred on Mr. H. W. CREMER, President of the Institution of Chemical Engineers. Members of the Institution of Gas Engineers were particularly gratified to learn, especially during the Annual Meeting, that the O.B.E. had been bestowed on Dr. W. T. K. BRAUNHOLTZ, the indefatigable Secretary of the Institution.

Obituary

Mr. T. G. MOFFATT, retired Manager of the Tradeston Gas-works of the Glasgow Gas Department, died on June 1 at his home at Carmunnock.

Diary

June 17.—**Lancashire and District Coke Association**: Annual General Meeting, Grand Hotel, Aytoun Street, Manchester, 11.30 a.m.

June 18.—**London and Southern Junior Gas Association**: Annual General Meeting. Presidential Address, C. A. Deas. Gas Industry House, 6.30 p.m.

June 19.—**Scottish (Eastern) Junior Gas Association**: Annual Outing, Fife.

June 19.—**Manchester District Junior Association of Gas Engineers**: Ladies' Day, Blackpool.

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June 19.—**Manchester District Junior Association of Gas Engineers**: Ladies' Day, Blackpool.

June 19.—**London and Southern Junior Gas Association**: Ladies' Day. Visit to Hatfield House as guests of the Tottenham and District Gas Company, preceded by lunch at the Cherry Tree Inn, Welwyn Garden City.

June 21.—**London and Counties Coke Association**: Finance Committee, 11 a.m.; Executive Committee, 11.30 a.m.; Central Committee, 1.30 p.m. All at Gas Industry House.

June 22.—**Yorkshire Gas Coke Association**: Annual Luncheon, Guildford Hotel, The Headrow, Leeds. 1 p.m. for 1.15 p.m.

June 23.—**British Gas Council**: Annual General Meeting, Gas Industry House, 3 p.m.

June 23.—**Federation of Gas Employers**: Monthly Meeting of Central Committee, Gas Industry House, 11.30 a.m. Twenty-sixth Annual Meeting, Gas Industry House, 4 p.m.

June 23.—**Western Junior Gas Association**: Summer Meeting and Ladies' Day. Visit to the Boot Factory of Messrs. J. H. Woodington, Clevedon.

June 29.—**Southern Association of Gas Engineers and Managers**: Summer Meeting. All-day visit to the coke oven plant at the Beckton Works of the Gas Light and Coke Company.

July 2.—**Waverley Association of Gas Managers**: Annual Meeting, Y.M.C.A. Hall, Edinburgh.

July 6.—**National Federation of Gas Coke Associations**: National Technical Committee, Gas Industry House, 2 p.m.

July 6.—**Solid Smokeless Fuels Federation**: Technical Committee, Gas Industry House, 3.30 p.m.

July 14.—**Technical Sub-Committee (Domestic Development Committee)**: 10.30 a.m., Gas Industry House.

July 14.—**Domestic Development Committee**: 2 p.m., Gas Industry House.

July 15.—**Solid Smokeless Fuels Federation**: Executive Committee, Dorchester Hotel, Park Lane, 11.30 a.m.

Nearly One Hundred Members of the London Association of the Women's Royal Naval Service heard a talk recently—one of a series arranged by the British Gas Council— on "Modernizing the Home." Miss Nan Currie, C.B.E., late Superintendent, W.R.N.S. Western Approaches, Chairman of the Association, presided. The audience included Miss Esta Eldod, M.B.E., Public Relations Officer of Radiation, Ltd.

REDUCED PROFITS AT COVENTRY

Rising costs have made it necessary for the Coventry Corporation to withdraw the rebate of a ½d. per therm to all gas consumers which they introduced last October. The cost of the concession during the six months of the financial year 1947-48 in which it was in operation was £19,590.

Under the general authority given by the Ministry of Fuel and Power to increase the price of gas by an amount which would cover the increased costs of coal and gas oil, Coventry would have been entitled to advance the price of gas 1½d. per therm above the ordinary scale charges. By reason of increased sales and internal economies, the Gas Committee was able to avoid passing on this extra cost, but if the accounts are to be kept stable they can no longer maintain the rebate of ½d. per therm.

This decision has been taken in connexion with the review of the undertaking's accounts for 1947-48. Mr. J. E. Wakeford, Engineer and Manager, points out the average price realized for gas was 10.55d. per therm compared with 11.36 the previous year. The cost to the domestic consumer was ½d. per therm less than in May 1942, and to the industrial consumer 2.8d. per therm less.

There was a decrease in gross profit on the undertaking compares with 1946-47 of £96,312 at £144,632. The net profit, at £35,156, showed a decrease of £51,601 on the previous year. Gas sold was 7.78%, up on the previous year with a total of 17,849,672 therms (3,966,593,778 cu.ft.). Bulk supplies to Birmingham (which in a full year will be a minimum of 500,000,000 cu.ft.) and to Rugby (minimum of 200,000,000 cu.ft. in a full year) accounted for 383,002 therms of the increase. The balance was due to increased demand.

A full year's bulk supplies to Birmingham, Rugby, and Nuneaton (minimum of 100,000,000 cu.ft. a year), now begun, require an increase of 25% in production and will give a minimum increase of £150,000 gross profit for a full year. Despite purchase tax, sales of appliances were up 40% on the previous year.

Mr. Wakeford says that although less than a quarter of a century ago the gas industry was considered in many quarters to be dying, there was now no doubt it had a great future. He points out that the output of the Coventry undertaking 25 years ago was 1,500 million cu.ft. per annum with an annual turnover of £400,000. To-day it is 4,300 million cu.ft. with a turnover of one and a half million pounds.

During the year a review of all commercial methods was made and as a result many innovations have been introduced. Special mention should be made in this respect of a completely new stores control procedure prepared for immediate introduction.

Following the general policy whereby working conditions for employees are being improved whenever possible, a bowling green was laid during the year at Gas Street and, in addition, larger and improved canteen premises were provided at the same depot. Arrangements are now in hand to erect suitable baths, changing rooms, and improved canteen facilities for the Foleshill employees.

The introduction of the Gas Bill into Parliament envisages the transfer of the undertaking from municipal to State ownership at an early date, which may well be April, 1949. It has been the policy of the Gas Committee to ensure that the maximum efficiency is maintained during the interim period and that the undertaking is handed over on vesting day financially stable, structurally sound, and planned with such foresight as will readily enable future expansion, both at the manufacturing station and on the distribution system. The current year's output is likely to be of the order of 5,500 million cu.ft. and Mr. Wakeford is of the opinion that even this putput may well be doubled within a period of 10 years. In this regard the Coventry undertaking is particularly fortunate in having at Foleshill the necessary space for such development.

At the end of a year, which from a trading point of view has proved very satisfactory (despite shortages of materials and labour, and continuing and more rapid increases in costs), appreciation is expressed to the Ministry of Fuel and Power for their very ready co-operation in the many projects introduced during the year and for the expeditious manner in which all vital problems have been dealt with. Thanks are also extended to the Chairman, Vice-Chairman and members of the Committee for their assistance during the year.

EXPORT LICENSING CONTROL CHANGES

Changes in export licensing control are made by a Board of Trade Order which amends the Export of Goods (Control) (Consolidation) Order, 1947. Among the goods which will not in future require export licences are building bricks, roofing tiles, cored solders and solder pastes, gas meters, domestic gas cookers, and pressed steel domestic baths. Additions to the list of licensable goods are beryllium and its alloys, beryllium oxide, and further specified types of munitions and munition making machines.

The changes in the schedules include: Group 6 (2). The items "Cookers, gas, of a kind used for domestic purposes" and "Gas meters of a type commonly used for registering and recording the consumption of coal gas" have been deleted; the item relating to domestic baths has been amended to read: "Baths (domestic) of enamelled cast iron, other than portable baths."

WOMAN'S ROLE IN THE NEW REGIME

ANNUAL MEETING OF THE W.G.C.

THE Thirteenth Annual General Meeting of the Women's Gas Council was held at the Central Hall, Westminster, on June 9. The Dowager Lady Nunburnholme (President) was in the Chair. She announced that the Rt. Hon. Hugh Gaitskell, M.P., Minister of Fuel and Power, who should have spoken to them that afternoon, was unavoidably detained in the House of Commons where the Gas Bill was under discussion ; but Mr. Alfred Robens, the Parliamentary Secretary, would bring the Minister's greetings. She accepted the invitation of the Executive Committee to be re-elected for another year of office as President.

Before asking the Secretary to present her report, Lady **Nunburnholme** thanked her for the efficiency with which she had carried out her new and interesting work. Great strides had been made in the W.G.C. since Mrs. Buchanan had become Secretary, and the inauguration of meetings of Branch Secretaries had been her work. It was important that people who had knowledge should not keep it to themselves, but should diffuse it, and these meetings were important in this respect.

Mrs. **Buchanan,** summarizing her Report, copies of which had been given to members, drew attention to the work of the Education Sub-Committee whose aim it was to give standardized training in the use of gas and gas appliances, and said a short syllabus for courses had been drawn up. It was hoped that this would be used in a number of technical schools next year.

She mentioned the Design Sub-Committee, who had prepared an introductory talk on design which had been given to a number of branches where small groups to study design had subsequently been formed. Questionnaires were being prepared by the Sub-Committee with the object of training the groups to offer constructive criticism. Dealing with Homecraft Courses, the Secretary made reference to Miss M. Godby, who organized these courses which were held all over the country.

New Branches Opened

Ten new branches had been established, and several more branches were expected to be formed early this year, and they were confident that they would be able to report many new branches next year. Miss Flack, who was appointed Branch Development Officer in November, 1947, was doing very good work.

Under Publications, Mrs. Buchanan mentioned that Miss Grant had left at the end of April, and that her work was now being done by a number of the staff. She thanked the Press for their support during the year, and reported on co-operation with the Ministries, especially the Ministry of Fuel and Power. She thanked Miss Pidsley for her capable assistance, and ended on the hopeful note that they were making progress in all directions.

Mrs. **Eric Evans** (Chairman, Cardiff Branch) proposed the adoption of the report, which was seconded by Miss **Lloyd** (Secretary, Brighton, Worthing and Shoreham Branches), who said that this report was not like the report of any other organization, but that there was a virile feeling about it, promising a great future for the W.G.C.

The adoption of the statement of accounts for the year was proposed by Mrs. **Waller** (Chairman, Stroud Branch), and seconded by Mrs. **Greenwood** (Secretary, Stoke-on-Trent).

Lady **Emmott** moved that Lady Nunburnholme be re-elected President, and did so with grateful thanks in the hope of favours to come. Miss **Ellington-Wright,** seconding the motion, said Lady Nunburnholme had never been just a formal figurehead, but had always come to all meetings, giving advice on all matters that concerned them. They were very grateful that she was willing to continue to do so.

Lady Milne-Watson, Lady Ogilvie, and Miss Faithfull, having resigned, Professor Winifred Cullis, Mr. A. E. Sylvester, Colonel H. C. Smith and Dr. E. V. Evans had accepted nomination as Vice-Presidents. Miss **Stampe** (Member of Executive and Secretary of the Grimsby Branch) proposed the re-election of Vice-Presidents. Miss **Wilde** (Member of the Executive) seconded.

The **Secretary** declared the result of the postal ballot for the election of the Executive Committee. Those elected were : Mrs. D'Arcy Bradell, Miss Ellington-Wright, Mrs. Greenwood, Miss Lloyd, and Mrs. Royle.

Mrs. **Pears** (Chairman, Cheltenham Branch) proposed, and Mrs. **Ayliffe** (Chairman, Worthing Branch) seconded, that Messrs. Cash Stone & Company be re-appointed auditors for the ensuing year.

Lady **Nunburnholme** introduced Mr. Alfred Robens, M.P., Parliamentary Secretary to the Fuel and Power, and one of the youngest Trade Union leaders. She indicated to Mr. Robens that the W.G.C. were eager to know what part they would have to play under the new set-up ; they, as housewives, were in a position in which few found themselves, namely, as link between industry and consumer. Women, she suggested, should sit on some of the regional bodies of the Gas Council. " We women have really a

Mr. A. Robens, Parliamentary Secretary of the Ministry of Fuel and Power, addressing the annual meeting of the Women's Gas Council at the Central Hall, Westminster.

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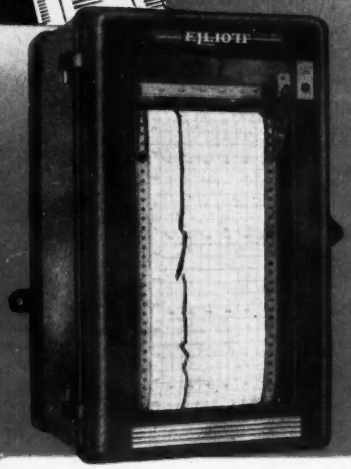

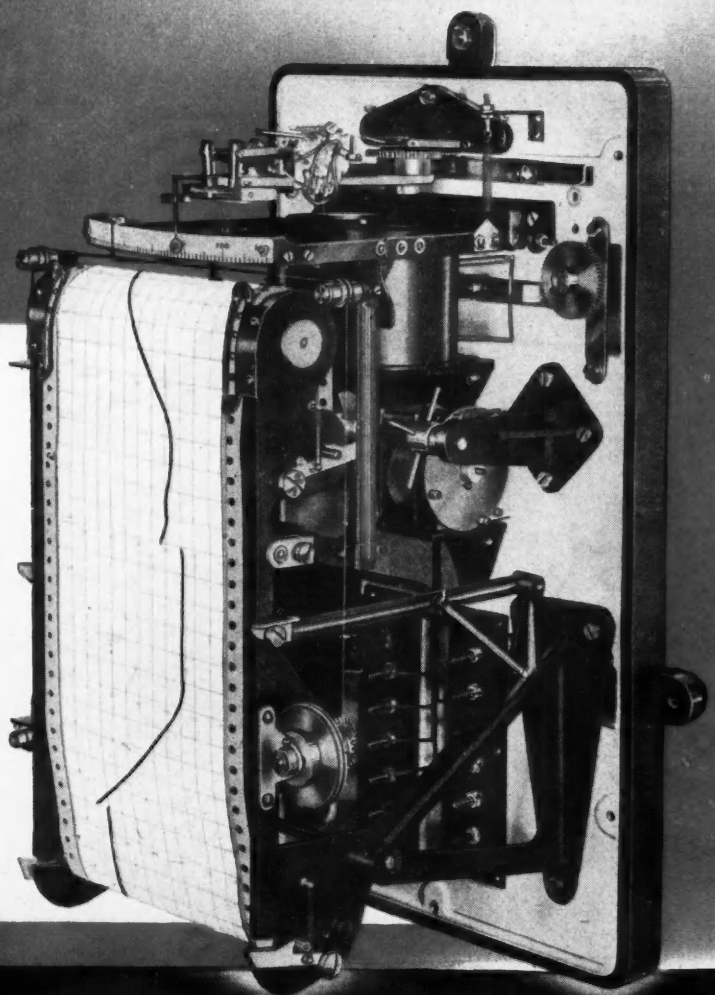

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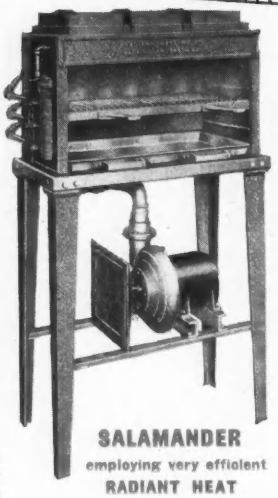

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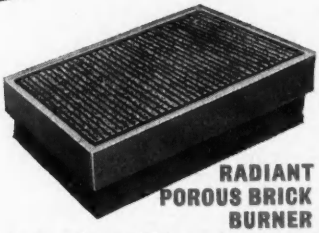

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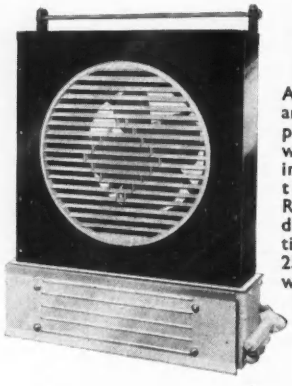
This illustration shows a high intensity porous refractory radiant burner to which is supplied low pressure gas and fan air. Surface temperature up to 850° C. with a maximum gas consumption of 0·75 cubic feet of 500 B.T.U. gas per sq. in. of refractory surface. Thousands of these burners are in every-day use for drying and processing work. With a proved radiant efficiency of 66% this is easily the best radiant burner known to modern science.



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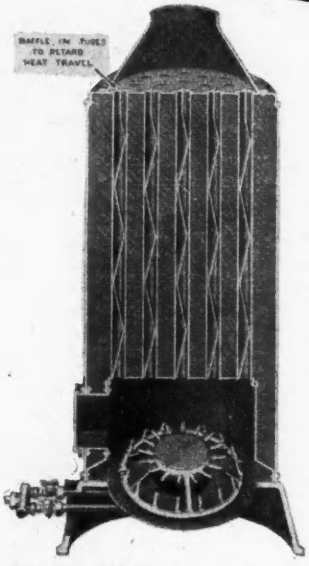

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A ROBUST heater that retains its efficiency for a number of years with very low maintenance costs.

Increased downward radiation with long life of jets.

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We guarantee this heater for 2 years and agree to supply free of cost any parts which may become defective during this period.

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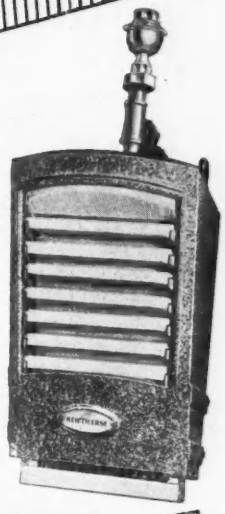

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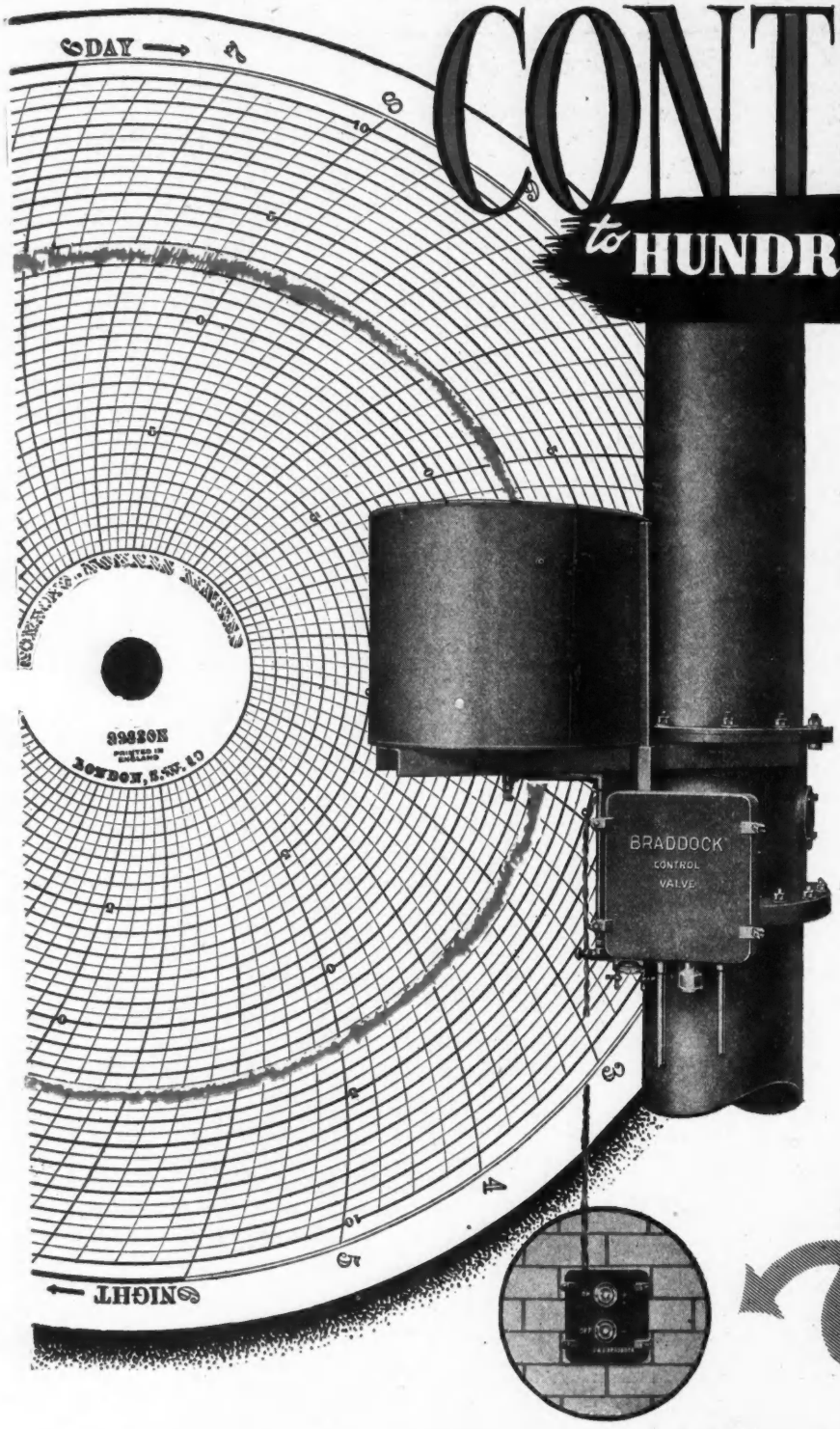

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part to play because we love our country with all our hearts," she said. She also referred to the Minister's wise choice of Chairman and Deputy-Chairman of the Gas Council.

Adequate Representation of Women

Mr. **Robens** expressed an apology on behalf of his Minister, who would have liked to be present himself that afternoon because he realized the importance of that occasion. He had been most anxious to come along himself, but was even then dealing with the Bill in the House of Commons. They had been having a fairly strenuous time recently, but there had been both seriousness and pleasantness. Parliament taught any individual tolerance, the capacity to listen to other points of view. As long as they had this tolerant way of dealing with questions they should be doing well.

He was glad Lady Nunburnholme had referred to the Chairman and Deputy-Chairman-Designate of the Council. They were all pleased that these appointments had met with universal approval. He was certain that the industry would go ahead in the new form under the leadership of such eminent men as Mr. A. E. Sylvester and Colonel H. C. Smith, and also that the progressive elements of the Ministry would not go forward as quickly as these men would wish.

He was under the impression that the Chairman had made her introductory remarks about the future of the W.G.C. with a purpose, and he believed that, quite apart from technical development in the gas industry, the success of the new organization would be largely dependent on intimate contact between the consumer and the industry. In this connexion the women of the country were, of course, most important because 50% of gas produced was used in domestic cooking. Eleven million householders were using gas, and the Consultative Councils were to form the link between the consumer and those responsible for the management of the industry. Much depended on the efficiency with which these Councils worked to achieve the best results in dealing with the wishes of the people. There should be an adequate representation of women on these Consultative Councils. But the mere representation of women and consultation with them was not enough. These women must themselves be intimately associated with the larger body of women in the country, and the W.G.C. was the best organization. The assistance of the W.G.C. would be invaluable.

Looking at the report of the W.G.C. for the year 1947-48, he was convinced that the educational work of the Council would do much to instruct women in the best use of gas for the purposes for which they needed it. It had been a great encouragement to them at the Ministry, especially at the time of fuel crisis, that immediately—and not after lengthy deliberation—the Council had plunged into the task. There was high appreciation for their work in the fuel economy campaign.

Nationalization of the gas industry did not mean the end of the work of their organization. Indeed, he believed it should be encouraged and should grow from strength to strength. It should make its influence felt over wider areas and should play a really big part in the development of the gas industry in the future.

He had not come in the guise of executioner. He had come as one welcoming the organization, as one hoping for its greater strength. The Ministry wished at all times to receive that full co-operation and help which it had always had from their Chairman and Council.

How Women Can Help

Colonel **H. C. Smith** thanked Lady Nunburnholme and the Parliamentary Secretary for their kind reference to the Chairman-Designate of the Gas Council, Mr. Sylvester, and to himself. They both fully realized the very important duty that had been entrusted to them. They were fully convinced that with the support from the industry, which they had been promised, they should be able to make a job of it. He had, the previous day, at the Institution meeting talked to the President, who was one of the heads of a firm of appliance manufacturers. The President had said it was impossible for the firm to know whether a certain alteration, which they had been asked to make, was wanted by consumers generally. The W.G.C. Design Committee could give a lot of help here; they could possibly tell them what alterations and improvements women would like. Women could help enormously in improving gas appliances. He thanked Mr. Robens for his talk.

Miss **K. M. Halpin,** O.B.E. (Chairman of the W.G.C.) seconded the vote of thanks.

Introducing Mrs. Norman Robertson, wife of the High Commissioner for Canada, the **Chairman** said that Mrs. Robertson was not born in the Empire, but came from that gallant country, the Netherlands; she mentioned with gratitude the reception, which the British delegation had been given at The Hague conference.

Mrs. **Robertson** described vividly the life of the Canadian housewife and the ways in which she coped with her problems. She said that 20 years ago gas was not often used for domestic purposes in Canada. Because of the great rivers and their utilization by engineers, there was a great surplus of electricity which was cheap. During the war domestic electricity consumption had to be reduced by 20%.

Mrs. Froggatt (Vice-President) proposed a vote of thanks to Mrs. Robertson, and also to the Canadian women for all they had done during the war.

INSTITUTION ASSOCIATES

In addition to the Members and Associate Members whose names appear in pp. 644 and 645, the following were elected Associates at the Annual Meeting of the Institution of Gas Engineers on June 8:—

Allan, H. W. (Cheadle and Churnet Valley).
Allen, A. L., B.A., B.A.I. (Alliance and Dublin).
Bartram, R. (East Hull).
Bolzinger, A. (Gaz de France).
Broadbent, N. (Ashmore, Benson Pease & Co., Ltd., Stockton-on-Tees).
Clay, J. B. (Alder and Mackay, Ltd., Edinburgh, and Vanda Meters, Ltd., Brierfield).
Coates, E. (Power-Gas Corporation, Ltd., Stockton-on-Tees).
Delbourg, P., D.Sc. (Gaz de France).
Duchêne, R., D.Sc. (Gaz de France).
Ewart, G. (Ewart and Son, Ltd., London).
Foot, J. A. A. (British European Airways Corporation).
Haddon, G. E. (Stockton-on-Tees).
Hall, J. P. (East Wight).
Hollis, F. J. (Hampton Court).
Howitt, T. R. (Pegson, Ltd., London).
Jackson, R. B. (Hathersage).
Lord, W. A. C. (Mid Southern Utility).
Manton, L. W. (Birmingham).
Pefanis, S., B.Sc.(Rand.) (Johannesburg).
Price, J. B. (Gas Light and Coke).
Renaudie, E. M. (Gaz de France).
Rowland, H. (Horsham).
Samways, L. C. (Robert Cort and Son, Ltd., Reading).
Saville, F. D. (Hastings and St. Leonards).
Sims, R. B., B.Sc. (Baker-Perkins, Peterborough).
Smith, G. R. (Gas Light and Coke).
Wilkinson, T. B. (William Wilkinson, Bi-Metal Manufacturer, Shustoke, Coleshill).
Wilson, R. E. (Imperial Chemical Industries, Ltd. (Alkali Division), Northwich.

BRADFORD GOVERNOR INSTALLATION

Two four-lift spiral guided holders at the Valley Road Station of the City of Bradford Gas Department receive gas direct by high pressure pipelines from the manufacturing station at Birkshall. The Bradford central area, Manningham, and Frizinghall districts are served from these holders through Bell type weight-loaded governors, the governors being situated in two governor houses, approximately 300 yards apart.

Recently, new governors have been installed to serve the same districts, and are housed in one new building. They will shortly be put to work and will replace the old governors. The new governors are by Messrs. Peebles, of the diaphragm pressure loaded type, clock controlled, each having a capacity of 200,000 cu.ft. gas per hour.

The governors are situated on an iron grille floor. The 18 in. diameter connexions and valves are immediately beneath at ground floor level. The governor room and the pipe room have been designed to give plenty of natural light and ventilation, together with good accessibility to all apparatus. Annexed to the main building at the back are an attendant's room, a small store room, and a boiler room.

The boiler room contains three gas-fired, thermostatically controlled boilers, for the dual purpose of heating the building and providing steam to the gas-holder anti-freezing apparatus.

The building was designed by the City Architect, Mr. J. T. Castle, A.R.I.B.A., A.M.T.P.I., on traditional constructional lines and the narrow window openings have the advantage that no constructional steelwork in the walls have been necessary.

The external solid walls are faced with Yorkshire sandstone, with brick backing, the stone facing being, on average, 5 in. thick, and the brick backing varying from 14 in. in the pipe room to 9 in. elsewhere. The walls are weight-bearing, and the whole structure is, due to existing site conditions, carried on a reinforced concrete raft. It is intended eventually to install distant control apparatus, when the station will be operated completely from a central control room elsewhere.

BIG INCREASE IN GAS CONSUMPTION

MINISTER'S WARNING ON CRITICAL STAGE FOR COAL

MR. HUGH GAITSKELL, Minister of Fuel and Power, stated at a Press Conference in London, on Thursday, that the whole outlook for coal was not so good as it had been. While the record of last winter was pretty fair there had been some disturbing tendencies in the figures both for coal production and consumption in the last few weeks; indeed since Easter.

In the first five weeks of the summer we wanted 19.2 mill. tons from the mines, but only 18.6 mill. tons were produced—over 100,000 tons a week short. Before then, deep-mined output was averaging nearly 300,000 tons per week more than in the corresponding weeks of 1947, but after Easter the excess fell to only 50,000 tons.

There appeared to be several reasons for the drop. Man power had not risen much since the middle of March, while output per man shift, which averaged 1.11 tons throughout the winter, was only 1.09 tons for the first five weeks of the summer; attendance had not improved since the winter, when it was always affected by sickness, as much as it should have done and the output of coal in the extra Saturday shift had been well below the level obtained during the winter.

Although we had something in hand in opencast production, we had been falling behind in deep-mined output, he said. A few weeks ago, he asked for another spurt in production, comparable with that which occurred last autumn. Output of deep-mined coal in the first week in June exceeded the 4 mill. tons mark for the first time since Mar. 20. He hoped that this meant that the spurt was beginning and that the steady upward movement in coal production, which stopped between Easter and Whitsun, had now been resumed. If so, we could reach the target, but we should only do so by a great effort by all concerned. The consequences of not reaching the target for deep-mined coal would be serious.

Increased Demands

Coal consumption in the first four weeks of this summer was 4.6% more than in the corresponding weeks in 1947. The greatest increase was by the coke ovens, where, to meet the needs of the iron and steel industry, coal consumption had been 16.4% higher than it was a year ago. But the feature to which he wanted to draw particular attention was the increase in the coal consumed by electricity stations and gas-works in the first five weeks of the summer. This was above expectation by 6.4% and 4.3% respectively, and, compared with a year ago, electricity sent out for public supply and gas similarly available (including supplies from coke ovens) was no less than 18.6% and 9.7% higher respectively. The last two weeks had been worst of all—consumption of gas had been 18.5% and 19.7% and that of electricity 40.4% and 31% last above last year. It was true that the weather had been colder so far this summer than it was last year; but this was nothing like enough to account for these increases in consumption. This really must not go on. Although the general coal position was much stronger than it was a year ago, we could not, as a country, afford to step up consumption so sharply for we had now to export very substantial quantities. Moreover, a good deal of the additional electricity consumption occurred during the periods of peak demand, and if it continued would lead to drastic load shedding next winter. This must not be allowed to happen and, therefore, he asked everyone to be more careful in using gas and electricity.

It was planned to have, by the end of October, stocks of 16.80 mill. tons. To achieve this we should have to put to stock this summer only 3.70 mill. tons as compared with 10.07 mill. tons last summer. Even so we had not done much towards it in the last four weeks. Total stocks should have risen by 625,000 tons, but had, in fact, risen by only 170,000 tons. This was, of course, the result of lower output and higher consumption. Since we must have sufficient stocks at the end of the summer to meet our winter needs, if output was lower, or inland consumption higher, than it should be, we should have no alternative but to reduce the rate of coal exports.

Coal Quality

Each coalfield, explained the Minister, has its own characteristics as regards the quality of its coal, but at every pit the coal produced is a mixture of different sizes. One cannot be sure—especially in the short period—that the different sizes and qualities produced are exactly what the market really requires, and this year it is pretty clear, when detailed consumption programmes are compared with the probable output of different sizes and grades of coal, that there will be a serious deficiency of large coal and a surplus of small uncleaned coal. About a third of the total deep mined coal production consists of large coal which is required by the railways, domestic consumers, some industrial consumers, and gas-works. Such coal is wanted by foreign customers and there will probably be a deficiency of some 60,000 tons a week of this coal.

The proportion of total coal obtained from the mines in small coal is about one-third, but owing to the great increase in mechanical mining in recent years, a greater proportion of this small coal needs washing or cleaning than before the war. It was impossible to add to the coal preparation plants during the war years, with the result that to-day there is an undue proportion of untreated smalls. Untreated smalls are, of course, already being consumed in this country to an appreciable extent by major industries. Power stations are taking nearly two-thirds of their coal in this form; but there is a limit to the proportion which industrial consumers can utilize.

Europe has recently been importing large quantities of American coal. British and other European producers cannot supply sufficient of certain qualities of coal, *e.g.*, coking and gas coal and large coal, to meet demand and so American coal had to be brought in. Most European countries are pretty well stocked with small coal and this makes it difficult to find a market in Europe for such coal.

Summing up, Mr. Gaitskell said: Last winter we did better than we expected. Production was above and consumption below estimates. So we were able to start exporting earlier and also to finish the winter with higher stocks than had been anticipated. Though opencast output has been higher, deep-mined output before Easter and Whitsun was below what we hoped and wanted. The result is that we are now getting behind in our progress towards the 1948 target for deep-mined output of 200 mill. tons. Exports have been rising at a satisfactory level but distributed stocks at home have not been going up as they should have done. This is due to output being lower and consumption higher than it should have been.

Consumption of gas and electricity has been rising sharply and even allowing for cooler weather, it is too high. Back to economy must be the directive. There is a prospective deficiency in large coal and surplus in untreated small coal. This is partly due to shortage of cleaning plant and partly to the fact that our export customers want proportionately more large coal and less untreated small coal than we ourselves consume. Since the proportion of small coal is greater with opencast, more opercast instead of deep-mined does not really solve the problem. If we cannot reach the deep-mined coal target we shall either have to cut home consumption of large coal or reduce our export programme. If we have to reduce exports, it will be bad not only because we shall not be able to export so much, but also because of the effect on our long-term coal exporting prospects.

I have tried to avoid painting too rosy a picture when things are going well or too gloomy a picture when we have setbacks. Nevertheless, I must warn you that we are at a critical moment in our affairs; the achievement of the coal export programme is in the balance, and nothing but a sustained effort on the part of all concerned can bring us through.

EVENING STAR LODGE

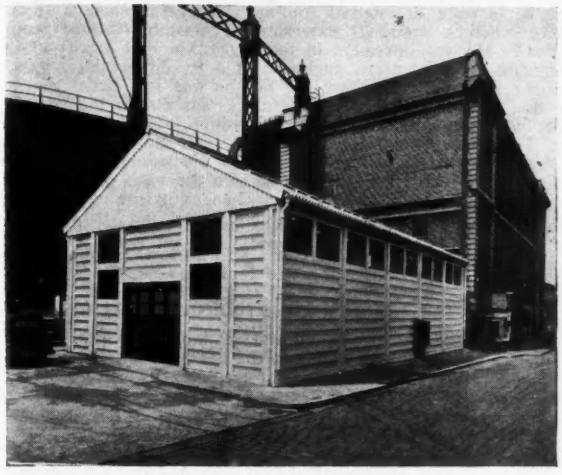
Members of the Northern Star Lodge (Manchester) and the Murdoch Lodge (Birmingham), and other masonic members of the Institution were the guests of the Evening Star Lodge on the Monday evening preceding Institution Meeting. There was an attendance of nearly 400 at the Freemasons Hall, Great Queen Street, and the Lodge proceedings were honoured by the presence of the Assistant Grand Master, Brig.-Gen. W. H. V. Darell. The W.M., Mr. J. S. Adams, extended a cordial welcome to all the visitors, including a large number of gas engineers holding Grand, London Grand, and Provincial Grand rank.

At the subsequent dinner in the adjoining Connaught Rooms, Col. W. M. Carr, recently elevated to the office of Junior Grand Deacon, responded to the toast of Grand Lodge. Sir Frederick J. West proposed the toast of the visitors, to which Mr. John Terrace, Hon. Secretary of the Institution (who was President in 1929), replied. Mr. Jacques Abady proposed the toast of the Masters of the Sister Lodges, response being made by Mr. G. W. Broughton (Northern Star) and Mr. D. Green (Murdoch).

In Our Report last week of the inauguration of the remote control apparatus at the Eccles Street gasholder station of the Liverpool Gas Company, it was stated in the caption under the photograph that the station controlled 20,000 cu.ft. of gas per hour. This should have read "200,000 cu.ft."

EXTENSION TO FULHAM RESEARCH LABORATORY

The Governor of the Gas Light and Coke Company opened an extension of the Fulham Research Laboratory on May 19. Speaking to representatives of the Directors and staff of the Company, Mr. Michael Milne-Watson recalled that the main laboratory nearby had been opened by his father and Sir Richard Threlfall 20 years ago. The architecture of the present building might appear to be rather utilitarian by comparison with the main building, but it provided very suitable accommodation for the work to be done. It was necessary to provide additional accommodation for the research staff engaged upon investigations on the gas-works and for other research work upon tar products which it had been decided to carry out there since the research laboratory at the Tar and Ammonia Works had been destroyed by enemy action during the war. The work of the Fulham laboratory was well known throughout Great Britain; indeed, its prestige was high wherever gas was known.



New extension to the Laboratory at Fulham showing the main research building.

Interior view of the extension to the Fulham Laboratory.

The laboratory building is of precast concrete and occupies a ground area of approximately 70 ft. by 36 ft. The structure was built by contractors but the whole interior was completed by the Company's carpenters, fitters, &c. It is well equipped to deal with problems which arise on the production side of the Company.

CROYDON CO-PARTNERSHIP: ANNUAL MEETING

In the absence of the Chairman of the Company, Mr. William Cash the Deputy Chairman, Mr. Harold Williams, O.B.E., F.R.I.C.S., presided at the annual meeting of co-partners of the Croydon Gas Company on June 1. As usual the Civic Hall was full to capacity with co-partners and their wives, and the business and social aspects of the event were pleasantly combined.

Mr. **Williams** commenced by explaining that the serious illness which had for some time incapacitated Mr. Cash unfortunately prevented his presence at the meeting. He had, however, received a letter from him which expressed his regret at being unable to attend a gathering which gave such a welcome opportunity of meeting old friends. Mr. Williams said he felt sure that all those present would like to pay tribute to the work the Chairman had done for the Company, and would agree to send him a message, drafted by the General Manager, expressing their good wishes. He was happy to be able to report that Mr. Cash was making a good recovery and he hoped that he would soon come back and give them the benefit of his advice and guidance.

Further news of the Chairman was conveyed by his son Mr. **William Cash, Jr.**, M.A., F.C.A., who remarked that when he had seen his father just 20 minutes previously, he had found him in fighting form and very much regretting his inability to join them. He continued: The Chairman's love and affection for the men and women of this great undertaking is greater than it ever was, and it was his wish that I should convey to you his best wishes for health and prosperity throughout your lives. The recent centenary celebrations were a great success, and I am sure it is my father's wish that you should be present at the next centenary; apart from the action of H.M. Government, that is not always an easy thing to attain. Looking back over the 100 years of the Company's life, one can say that it has served this town and the surrounding district well and has given, through you and your predecessors, a service of which any company of men and women in this country might well be proud. There are changes coming; we know all about them, but we do not know how they will work out. But I am sure of this—that when we are called to serve in the great gas industry of the future, we can do no better than carry into that service some of the ideals of loyalty, co-operation, service to others, help to those who need it, and ability to put one's back into a thing without regard to monetary reward, that we have learnt in this Company in the past.

Turning to the annual report, Mr. **Williams** commenced by extending a very hearty welcome to all co-partners who had returned from H.M. Forces during the year; at present there were 45 employees on service. During the year membership had increased by 74, there being 926 co-partners and 289 pensioners. The bonus for the past year remained at 6% and amounted to £18,599—a decrease of £1,432 on the previous year. Savings had increased during the year by £2,085, the total amount being £9,851. In connexion with the Hospital Scheme, £207 had been donated to seven hospitals. The national savings group was making good progress, membership was 318, and 44,466 certificates had been purchased since the date of formation. Since the release from requisition of the sports pavilion and ground in June, 1946, the Sports Club had made good progress and the present membership was 580.

The Gas Bill had been published in January and it was a source of great disappointment to learn that co-partnership in the industry was to be abolished, and that no definite terms for compensation for the resultant loss were stated. Since then opposition to these provisions in the Bill had grown throughout the industry, and many protests had been made by co-partners in other gas companies. The Standing Sub-Committee of Co-Partners' Representatives had not been inactive in this matter, and had sent to the Prime Minister, the Minister of Fuel and Power, and to all the members of the Parliamentary Committee considering the Bill, copies of resolutions expressing their regret at the Government's intention to close down co-partnership and asking that the Bill should be amended to provide clearly that no employee shall be placed in any worse position under nationalization. A deputation had also called upon local Members of Parliament, and upon Mr. Hayday, of the National Union of General and Municipal Workers, to invite their support for the amendment of the Bill. While the Bill was being considered in Committee, the Government introduced an amendment by which provision was made for the continuance of co-partnership schemes for "such period after the vesting date as may be specified by regulation, with such adaptation and modifications as appear to the Minister to be necessary or expedient" and an Area Board or the Gas Council might agree with representative organization to replace an existing scheme with a new one, and where any such scheme ceased to have effect, regulations might be made for the winding up of the scheme and the distribution of the assets. That last sentence, said Mr. Williams, was an enormous improvement on the Bill as first drafted, and they were indebted to the Sub-Committee for the valuable work they had done.

Mr. **J. L. Bates**, Secretary of the co-partners representatives on the Co-Partnership and Works Joint Committee, then delivered his report.

During the meeting Mr. Williams made long-service awards to 35 co-partners who had completed 25 years' service.

REMOVAL OF TAR, NAPHTHALENE, AND AMMONIA

OWING to the lateness of the hour there was only a brief discussion on the paper on "The Removal of Tar, Naphthalene, and Ammonia from Gas," which Dr. S. Pexton, Mr. G. Dougill, and Mr. L. A. Ravald, of the Gas Light and Coke Company, presented to the Spring General Meeting of the Southern Association of Gas Engineers and Managers on May 25. Following is a report of the discussion. (The paper was published in the "JOURNAL" last week, pp. 539-544.)

The **President** (Mr. H. J. Escreet) congratulated the authors on having put the whole question of purification in a nutshell and regretted that time would not permit of adequate discussion of the many important aspects raised.

Mr. **J. W. Townsend** (Tunbridge Wells) said the paper was extremely comprehensive, and he was glad to see that some of the troubles which the authors now regarded as minor ones, but which originally seemed to be major ones, were in process of being overcome. He was particularly interested in the solution of the condenser tube problem. As Mr. Dougill had mentioned, it might be that water and other conditions at Beckton were peculiar—and they were not the only things that were peculiar to Beckton. He recalled that they expected a great deal from their wet purification plant. They expected the ammonia washers to remove ammonia and a large amount of tar and naphthalene. It was difficult, not having seen the paper beforehand, to go into detail, but there were a few points regarding naphthalene which was worse in coke oven plant than in any other. One wondered whether the free space above the charge in the top of the oven gave rise to the heavy concentration mentioned by Dr. Pexton. With intermittent verticals the amount of free naphthalene was very much less and the amount of tar oil dissolved in the naphthalene was very much greater. He wondered why it had been decided to use rotary washers filled, as he understood, with boards, when there were quite reasonably good static washers on the market which he imagined would use rather less power. If the production of naphthalene could not be overcome, would it not be possible to remove it in a primary cooler, using cooled tar as the cooling medium to dissolve the naphthalene and cool the gas at the same time. Such an arrangement would use less power than was necessary in the case of duplication of plant, having two electrostats and a separate naphthalene washer.

Ingenious Arrangement

Dr. **R. Lessing** said the arrangement for the collection of the naphthalene was an ingenious one, and the only question he wanted to ask was whether, if the whole of the naphthalene and tar were removed and a really clean gas was passed into the ammonia scrubber, it would obviate treatment in the very interesting plant which had been installed at the Product Works at Beckton, which he had had the pleasure of seeing, in which the tar acids were extracted from the ammonia liquor before the liquor was distilled. It appeared to him that if the gas was as clean as one might expect, the proportion of ammonia liquor coming from the coke oven plant would not need to be treated in that plant, because it would not contain any tar acids.

Dr. **G. E. Foxwell** said Dr. Pexton would remember that he was a colleague of his when the coke ovens were proposed, and then he went over to the contractors' side, but he was present at the starting up of the plant and was aware of the difficulties which had been described. He would not like gas engineers to go away with the idea that all coke ovens were subject to all such difficulties. Beckton had had more difficulties than were usually experienced on coke oven plants, and certainly the difficulties in starting up at Beckton were greater than any he had experienced elsewhere. One reason was that instead of adopting the usual coke oven by-product recovery system they decided to adopt a highly ingenious system not tried before, and had used the system which Dr. Pexton had described in order to increase the ammonia content of the liquor. It was a very ingenious system indeed, but as it had not been tried before there were many difficulties. Another reason for the difficulties was that there was no benzole recovery on the plant itself. He thought the main reason for the difficulties was the free space in the ovens, and here they came back to the question of design. This was the first English coke oven plant since that installed at Birmingham, and the late Mr. Thomas Hardie said he wanted a high gas yield, which meant they must have a higher temperature at the top of the ovens. Instead of the coal staying at the top there was a general shrinkage, and the space at the top was hotter than was contemplated. They had to mix some Kent coal with that which they were then using. Whether the charge still continued to shrink he did not know, but if it did he thought that was the reason for the naphthalene content when ovens were too hot at the top.

Mr. **C. Cooper** (W. C. Holmes & Co., Ltd.) agreed with the authors in considering that continuity was of the highest importance when dealing with so large a gas stream, and to achieve continuity they had introduced some new ingenuities. There was, however, an inconsistency in the fact that they were content to introduce additional cooling surface in the primary condensers in order to secure continuity, but in the ammonia washers they proposed to achieve their object in a different way. He could claim acquaintance with many types of ammonia washers, and he really thought that most of them carried out the functions for which they were designed, and others for which they were never designed, without any great loss of washing efficiency, that is, in spite of internal fouling. Why introduce a special device when a moderate extension of washing surface would suffice? He was interested in the suggestion that a part of the corrosion in condensers might be due to differential aeration brought about by mud deposits, but he was still under the impression that a good deal of the attack was due to the fact that tubes were not unstressed when in position. He thought it was Mr. Townsend who had suggested that tar might be a useful washing agent for naphthalene removal. He would like a clearer definition of tar before accepting it. On the basis of determinations he had carried out, on how much naphthalene could be dissolved in tar at various temperatures, it did not strike him as likely to be effective.

The **President** regretted that there was no further time for discussion, and invited the authors to reply in writing.

Absorption Problems

Mr. **T. C. Battersby** (Watford and St. Albans) proposed a vote of thanks to the authors and said the gas industry owed a great debt of gratitude to Dr. Pexton for the work he had undertaken in the past on behalf of the industry in general and the Southern Association in particular. With his colleagues he had been able to pursue his experiments over four streams of gas from the coke ovens and to reap the benefit of knowledge gained in earlier experiments. The President had said they had put their story in a nutshell; he could only exclaim "It must be some shell." They had listened to the authors' accounts of the absorption of naphthalene, and the members must now face their own problem of the absorption of the contents of this valuable paper, to which they could not do justice that afternoon. It had been appropriate to learn something of the coke oven operations at Beckton in view of the approaching visits of the Institution and the Association. The paper would add enormously to the interest in those visits. He had been especially interested in Mr. Dougill's remarks with regard to condensing problems and the failure of tubes. In his own first experience with water tube condensers a few years ago all the tubes collapsed within 24 hours and could be broken like match sticks. They then tried other tubes, which had been in use for 15 or 16 years without showing any signs of deterioration. He was also pleased to note from the paper that the authors had found a use for emulsified oils.

Mr. **C. Stott** (South Metropolitan Gas Company) seconded the vote of thanks for what he described as a very stimulating paper in which they had been reminded that the chief question in connexion with tar, naphthalene, and ammonia removal was when and where to remove them. He did not know whether they would ever completely solve the problem because they would always be up against limitations of design and limitations of atmospheric conditions.

Dr. **Pexton,** in a brief reply, said the authors appreciated the rapt attention with which the members had listened to the presentation of the paper. He also thanked those who had contributed to the discussion. They had not expected that there would be any discussion, but they would do their best to answer in writing some of the useful and illuminating points that had been raised.

NALGO MEMBERSHIP

With a membership of 171,000—an increase of 24,000 in the past year—the National Association of Local Government Officers is now the biggest trade union of non-manual workers in Britain, and probably in the world. In addition to local government staffs, the Association now includes within its membership the officials of the nationalized electricity industry and employees of gas companies and voluntary hospitals who are about to be nationalized. It has played a part during the past year in establishing joint bargaining machinery for the electricity, gas, and national health services. The scope of the Association's work is shown in the fact that, in the past year, its annual income increased from £162,226 to £215,939, its reserve fund from £66,022 to £146,136, and the income of its benevolent fund from £33,772 to £37,636.

In 24 trade disputes reported to the Minister of Labour, the Association won its case in all save one (apart from one deferred for further investigation). It secured pay increases for the general and clerical grades of the local government service and for women in the administrative and professional grades, and better salary scales for particular classes of officials. The Association's legal department advised members in 1,000 legal cases and made representations in protection of their interests on many Parliamentary Bills and Orders. Its public relations department assisted in the preparation of 50 local Government exhibitions.

EXPERIMENTAL WORK ON DURHAM AND NORTHUMBERLAND COALS

By BERNARD RICHARDSON, Newcastle-on-Tyne and Gateshead Gas Company

Address as Chairman of the North of England Gas Managers' Association (Auxiliary Section), June 4, 1948

FOR the subject of my address I have decided to describe the results of recent experimental work carried out on Durham and Northumberland gas coals in the Redheugh laboratories.

Some time ago we commenced a search, which I fear is likely to prove prolonged, for a laboratory coal assay apparatus that would enable us, quickly and accurately, to assess the worth of a coal to a gas-works. This is a difficult matter because of the many factors involved such as, for instance, ash content, volatile hydrocarbon content, swelling power, and carbonizing rate. A rich gas coal may lose a considerable part of its value if the whole of its available gas cannot be obtained without prolonging the carbonization period beyond a certain limit, while a variety excellent in all other respects may, by virtue of its swelling propensities, give rise to difficulties when used in continuous vertical retort installations.

One of the types of small-scale assay apparatus whose possibilities we determined to investigate was the Gray-King. In this, as you probably know, 20 g. of dry coal ground to pass a 60 I.M.M. sieve is heated under standardized conditions in an electric furnace provided with a pyrometer to 600° C. The yields of gas, tar, ammoniacal liquor, and coke obtained can be weighed or measured, and it is claimed that the results throw light upon the general properties of a coal and permit its behaviour to be predicted when carbonized on the large scale at the same temperature.

Our experience with the apparatus showed that, while it furnished useful information as regards the nature of the derived coke as a guide to the gas-yielding proclivities of a coal, under conditions of high temperature carbonization it was of little use. Neither did it allow us to ascertain the relative rates at which different coals evolved their gas when heated to 800° C. or 900° C. In fact we found it quite impossible to discover a factor correlating Gray-King figures with our retort house results. One further decided drawback to the apparatus lay in the fact that the diameter (21 mm.) of the silica distillation tube was too small for the majority of the Durham coals examined.

Intumescence and frothing caused a portion of the charge to be forced beyond the hot zone of the furnace and resulted in imperfect carbonization of the ends taking place, while it was also a matter of considerable difficulty to extract the coke residue from the tube. It is true a modification of the method has been devised which is said to overcome this trouble. In this the coal is mixed with a proportion of finely-ground coke or electrode carbon to counteract the swelling propensities, but as I never could persuade myself that this was a satisfactory solution to the problem I proceeded to experiment with a tube possessing an internal diameter of 32 mm. As a result our troubles vanished and very concordant figures could be obtained with the most recalcitrant types of coal.

Modification of the Gray-King Assay

The whole assay apparatus was then modified on the lines suggested by Mr. John Wilson, of Motherwell, in his Presidential Address to the North British Association of Gas Managers as long ago as 1926, and further described by his successor, Mr. A. McDonald, in 1931.

Ten grammes instead of 20 g. of coal were used. The furnace was heated to 300° C., at which point the tube and its contents were inserted. The temperature was subsequently raised at such a rate that 900° C. was reached at the end of 40 min., being maintained at that figure for a further 20 min., by which time gas evolution had practically ceased. The rate at which the gas was given off throughout the temperature range, the final corrected volume of gas obtained, the weight and nature of the residual coke, together with sundry other relevant data, were ascertained for a number of Durham and Northumberland coals as well as for coals from most of the other British coalfields, including Kent. It is, however, with the results from the Durham and Northumberland varieties that I wish most particularly to deal in this address.

As regards the Durham coals it was found that practically all gave off their gas in a very characteristic manner between 300° C. and 900° C. There are three distinct peaks at which the gas is given off at a maximum rate. The first occurs at about 575° C. and is by far and away the most pronounced, the second, which is not clearly shown by all coals, is at 640° C.-690° C., while the third lies between 730° C and 750° C. The magnitude of the first peak may be taken as a measure of the swelling powers of a particular coal, for the more pronounced it is the more expanded and porous is the coke cylinder left in the tube at the end of the experiment. The incidence of this peak is heralded at about 550° C. by the rapid disengagement, sometimes with almost explosive violence, of a greenish yellow or brown vapour from the coal which condenses to a mixture of tar and water in the first tube of the assay apparatus. Immediately after the rush of vapour, gas begins to evolve at a rapidly accelerating rate until the maximum is reached after about 2½ min. Then as rapid a decrease occurs.

The composition of the gas taken at the height of the peak (*i.e.*, at 575° C.) varies little with different Durham coals.

It approximates to the following:

H_2S and CO_2 ..	−3.5%
CnHm	−4.5%
CH_4 and C_2H_6 ..	−88.0%
CO	−4.0%
H_2	−Trace

The vigour and suddenness with which the first quick evolution of gas takes place indicates that at this particular point an exothermic reaction is initiated, and that it is due probably to the molecular rearrangement and decomposition of certain definite constituents of the coal, which in the case of Durham gas coals make up a considerable proportion of their substance.

Four separate 10 g. samples of a strongly swelling Durham gas coal (designated a, b, c, and d) were weighed out and each in turn placed in the silica tube of the assay apparatus. Sample (a) was withdrawn when the tube temperature reached 475° C., sample (b) at 500° C., sample (c) at 550° C. when the evolution of brown fumes had just begun, and sample (d) at 590° C. when the peak rate of gas liberation had passed. It was found that (a) formed a coherent mass showing incipient signs of fusion but still presenting the size and shape of the original coal. Sample (b) was fused and swollen to about three times its volume, and samples (c) and (d) had expanded to no less than five times the volume of the coal. The swelling process had, therefore, commenced somewhat below 500° C. and was complete at 590° C. Thus there is little doubt that it is the rapid rate at which gas is disengaged between these points that blows out, as it were, the plastic mass into a spongy and voluminous coke.

The composition of the gas given off at about 740° C. was found to be as follows:

H_2S and CO_2	0.8%
CO	6.0%
CH_4	14.3%
H_2	78.0%
N_2	0.9%

It is significant that even at this relatively low temperature the chief constituent of the gas is hydrogen, methane having fallen to just over 14%, while the unsaturated hydrocarbons have entirely disappeared. Above 800° C. the rate of gas evolution rapidly slackens, the while its hydrogen content steadily increases. At 900° C. 82% of the gas then being given off consists of hydrogen, but there is still about 8% by volume of methane present as well.

The degree of swelling and also the height of the 550° C.-590° C. peak are affected by the percentage of shale or stone present, which, of course, tends to weaken the plasticity of the coal and allows the gas to escape more freely. Consequently, if the ash content of a reasonably clean Durham coal is increased by, say, 3% to a total of 9%, the volume occupied by the coke in the assay apparatus is reduced by about one-third and in some respects it may even be regarded as improved both with respect of strength of structure and to the ease with which it burns. This, of course, refers to coal that has been ground before carbonization has taken place, and the statement must not be taken as a justification for the presence of shale in a strongly-swelling type of coal. The evil effects of "dirt" far outweigh any advantages in the direction mentioned, and the same effect may more felicitously be brought about by the admixture of a proportion of coke breeze or non-coking coal with the swelling variety.

"Float and Sink" Results

In order to eliminate the disturbing factors caused by varying quantities of inert material, this was separated from a number of typical Durham gas coals by a "float and sink" method using carbon tetrachloride (Sp. Gr. 1.60) as the liquid medium.

After drying the floating portions of the coals in the water oven at 105° C. for one hour, they were put through the assay apparatus, all assays being carried out in duplicate. The ash contents of the coals varied between 3.0% and 3.9%, and the volatile matters from 30.0% to 32.2%.

It was found that as regards gas make, gas composition, and thermal yields of gas per ton, almost identical results were obtained, but when the natures of the cokes were examined marked differences became apparent. Some cokes were exceedingly spongy and swollen so that when removed from the tube they occupied about five times the volume of the coal. They could, in fact, not inaptly be described as petrified froths. Other coals gave much more compact and dense cokes not exceeding two to two-and-a-half times their own volume. All exhibited in varying degree the characteristic gas evolution "peak" at about 575° C., but those which swelled to the greatest extent on carbonization gave the highest peaks extending over the shortest temperature range.

Coals with well-developed swelling properties, it was found, were all fairly soft and crumbly, and consisted almost entirely of bright, jet-black clarain and vitrain. Coals giving a more compact coke, contained, in addition, varying amounts of dull-black durain, and in one or two cases a proportion of semi-cannal. The latter types are more suitable for use in continuous vertical retorts than the swelling coals. Durain, it should be noted, gives no "peak" evolution of gas at 575° C.

The composition of the gas obtained from Durham gas coals tested in the assay apparatus as described is quite characteristic of these coals, and on the air-free basis approximates very close to the following:

H_2S and CO_2 ..	1.7%
Cn Hm	1.1%
CO	5.5%
CH_4	33.0%
H_2	58.0%
N_2	0.7%
Gross calorific value	600 B.Th.U.

A perusal of the figures shows that the volume of unsaturated hydrocarbons (CnHm) is considerably lower than one usually finds in high temperature gas generated in horizontal or continuous vertical retorts, while the oxides of carbon, methane, and hydrogen contents are not greatly different from what is generally found in large-scale practice, though, if anything, the hydrogen is somewhat higher.

Analyses made of the assay apparatus gas have shown that at 350° C. this contains about 8% by volume of unsaturated hydrocarbons, the content falling to 6.5% at 580° C. and disappearing entirely between 650° C. and 670° C. These bodies are certainly primary products of distillation and their evolution is complete almost before the coal has attained to a faint red-heat. For this reason their disappearance cannot be attributed to decomposition by pyrogenic reactions into carbon and hydrogen or hydrogen and methane, because the semi-carbonized coal on the outside of the 10 g. taken for the test is still well below the temperature necessary to effect this when the evolution of the unsaturated bodies ceases.

The considerably higher percentage of the latter obtained during large-scale carbonizing operations must, therefore, be traced to the decomposition of tar and oils derived from the inner portion of the coal charge, which, owing to the relatively low rate of heat penetration, only begin to be evolved long after the outside of the charge has reached a bright-red heat and becomes completely coked.

The tar from the 10 g. of coal in the assay apparatus is produced between 550° C. and 650° C., being equivalent to some 20 or 25 gal. per ton. A complete analysis has not been made, as yet, of this tar, but qualitative tests have definitely shown it to consist mainly of unsaturated hydrocarbons and paraffins. During the passage of a tar of this composition through hot coke, and also as the result of contact with the heated retort walls, lower members of the olefins unsaturated hydrocarbons would be produced by "cracking," in sufficient quantities to account for the 2.0 to 2.5% of those bodies usually found in modern high temperature coal gas.

As the result of this "cracking" process nearly half the tar is converted into permanent hydrocarbon gases, hydrogen, and free carbon, and the remainder, some 10-11 gal. per ton of coal, which runs the gauntlet of the "ordeal by fire" in the retort, only does so at the expense of becoming metamorphozed almost entirely into stable aromatic bodies containing more carbon and less hydrogen in the molecule than the primary oliphatic compounds.

In order, therefore, to translate the thermal yield of gas obtained by the assay apparatus into the equivalent to be expected on the works, it becomes necessary to multiply the figure by a factor, which for Durham coals is 1.2. Thus if a coal gives, on assay, 62.0 therms of gas, it should be possible under optimum conditions to obtain from it $62.0 \times 1.2 - 74.4$ therms on a horizontal installation. The difference between 74.4 and 62.0 therms—*i.e.*, 12.4 therms—may be attributed to "cracking" of the primary tar in the retorts.

Behaviour of Northumberland Coals

The behaviour of Northumberland coals in the assay apparatus presents many contrasts with Durham gas coals. The Northumberland coals yield from 35% to 38% of volatile matter, are partly oxidized, and contain a larger amount of inherent moisture. The coke is of a non-swelling nature equal to or rather less than the volume of the coal. In some cases it presents a fused appearance and in others the separate particles of carbonized coal are still clearly descernible in the conglomerate.

Although the average percentage of volatile matter for the Northumberland coals tested is about 36% as compared with 31.5% for Durham varieties of like ash content, the latter give about 3.5 therms more gas per ton. The rate at which the gas is evolved from Northumberland coals is, moreover, profoundly different. Instead of the pronounced "peak" at about 575°C., indicating rapid disengagement of gas for a relatively short period, the Northumberland coals yield their gas at a much steadier rate over a wider range of temperature and do not show such high maxima and minima as do the Durham swelling varieties.

The first gas is heralded at about 330° C. by the appearance of a quantity of water vapour, but there is nothing akin to the violent disengagement of yellow or brown tar vapour so characteristic a feature of Durham coals. The tar from Northumberland coals is much lighter in colour and it is frequently found very difficult to condense it in the apparatus.

The average composition of the gas obtained from the assay of several samples of these coals was as follows:

H_2S and CO_2 ..	3.2%
Gn Hm	2.0%
CO	7.2%
CH_4	33.8%
H_2	50.3%
N_2	3.5%

The figures may be compared with the analysis of the gas from Durham coals, which I have already given. The higher percentage of carbon oxides in the high volatile coals together with the smaller volume of hydrogen obtained from them may be taken as a measure of the degree to which oxidation has occurred. It should be noted, however, that the content of unsaturated hydrocarbons is approximately twice that found in the gas from Durham varieties. This is not just an adventitious phenomenon but is consistently shown in consecutive tests made under most carefully standardized conditions.

Analyses of the gas given off by both Durham and Northumberland coals over the temperature range 560° C.-700° C. showed that much higher yields of unsaturated bodies were indeed given by the latter coals for a longer period, as the accompanying table indicates:

Temperature (°C.)	Percentage unsaturated hydrocarbons in gas (A) Durham coals	(B) Northumberland coals
560	5.0	9.0
660	0.4	1.4
700	Nil	0.2

Samples of durain or bone coal separated from various coals including specimens from the Durham fields were found to give a gas very similar in composition to that from Northumberland varieties, including an unsaturated hydrocarbon content of from 2.3 to 2.5% by volume. The Northumberland coals contain a large proportion of durain, so it is probable that it is this constituent of the coals which is responsible for the unsaturated bodies. There is, of course, the possibility that the presence of steam evolved from the coal substance may exert some "shielding" effect upon these hydrocarbons, but this is pure speculation.

Other coals examined up to the present which give a gas containing more than 2.0% of unsaturateds are Ayrshire (2.2%), Derbyshire (2.3%), certain Lancashire varieties (2.2%), and Irish peat (2.2%). All these yield over 35% of volatile matter in a proximate analysis. Rather curiously, Bovey Tracey lignite yielded only 1.3% of unsaturateds in the derived gas.

Returning for the moment to the initial "peak" period of gas evolution shown by Durham gas coals and some Lancashire coking coals such as those from the Mountain Mine seam, I would repeat that with one or two notable exceptions all the coals exhibiting this in a marked degree give an intumescent type of coke occupying many times the volume of the parent coal. Several coals, especially those from the Sunderland area, it is true, exhibit a less sharply defined peak period and the cokes derived from these are of a dense nature, but this fact can be explained by the presence of durain in the coal substance. If the latter is removed the remaining portion comprised mainly of clarain and vitrain swells strongly when heated.

There are, however, certain thin cannel-like bands found in some Durham gas coal seams which exhibit a pronounced peak between 560° C., and 600° C., and yet give a non-swelling residue when carbonized. These are dull black in colour and superficially resemble bitumen or solid pitch. They contain about 8% of ash, and from 33 to 34% of volatile matter other than moisture. The ash is pale grey or white.

An exceptionally rich gas may be obtained from them in the modified Gray-King apparatus, the average composition on the air-free basis being as follows:

H_2S and CO_2 ..	2.2%
Cn Hm	5.5%
CO	4.2%
CH_4	39.2%
H_2	47.4%
N_2	1.5%
Gross calorific value	720 B.Th.U.

On the large scale such a coal should give up to 88 therms per ton when carbonized in horizontal retorts. Unfortunately it is an extremely difficult and expensive matter to segregate this variety

from the rest of the output, otherwise it could provide a means at the present time for meeting winter peak loads without installing extra plant.

Between 560° C. and 700° C. and especially during the peak period the gas from the semi-cannel is very rich in unsaturated hydrocarbons of the olefine series as may be seen from the following figures which are the average of a considerable number of analyses made during the past year or so:

Temperature °C.	Unsaturated hydrocarbons in gas (semi-cannel) %
560	14.8
660	10.1
700	1.4
750	Trace

The coals give no subsidiary peaks at 640° C. or 750° C.

Interpretation of these facts is no easy matter, but having regard to the high percentage of unsaturated bodies present, both in the gas and in the tar derived from the semi-cannel, it would seem that the constituents which decompose so rapidly at about 575° C. are of a resinic nature.

It is well known that extraction of a strongly-coking coal by organic solvents such as aniline, pyridine, or phenol weakens the coke, while inferior coking coals may have this property entirely destroyed. Accordingly we decided to find out what would be the effect of treating a Durham gas coal with one of the more readily available solvents. The coal chosen gave a swollen coke occupying three times its own volume and exhibited the usual pronounced " peak " in the distillation rate curve at 575° C.

The solvents employed were pyridine and aniline but the results from the former proved most disappointing. After treating the finely-ground coal in a Soxhlet type of apparatus for a period of four days only 3% by weight of extract had been obtained. The solution of the extract in pyridine was dark brown and opaque with a trace of fluorescence, so that it gave the impression that much more coal substance had been dissolved than actually proved to be the case.

The extract was recovered from the pyridine by first distilling off the bulk under diminished pressure and then acidifying the residue remaining in the flask with hydrochloric acid. The precipitate obtained in this manner was filtered off, well washed with pure dilute hydrochloric acid and distilled water and finally dried. It proved to be a chocolate-brown amorphous powder of bulk density much less than the untreated coal. The similarity in appearance between this extract and certain solid gum deposits recovered from the distribution system over the past eight years, struck one at once.

However, since only a small amount had been obtained as the result of prolonged extraction we decided to pass on at once to aniline (B.P. 184° C.) and proceed with an extraction on the lines described by Vignon (*Comp. Rend.*, 1914, 138, p. 1421).

By boiling the coal with five times its weight of aniline under a reflux condenser for four hours and treating the dark-brown solution obtained in the same manner as described for pyridine, 7.2% by weight of a dry brown extract was isolated. The residue insoluble in aniline was likewise after washing with acid and distilled water dried in the water oven. It seemed to the eye indistinguishable from the untreated coal.

More extract could undoubtedly have been obtained by prolonging the boiling period beyond four hours, and it is certain that in addition to exerting a solvent action pure and simple upon some of the constituents, the aniline also slowly attacks and resolves the complex structure of the coal as a whole into simpler molecular aggregates.

Having now procured a sufficiency of both extract and residual coal, a series of tests was made upon these. First of all the proximate analyses were ascertained and compared with the parent coal. I give the resulting figures in Table I.

TABLE I.

	(A) Original coal %	(B) Aniline extract %	(C) Residual coal %
Volatile matter ..	30.9	55.0	29.4
Fixed carbon ..	62.8	45.0	64.2
Ash ..	6.3	Trace	6.4

The coke " button " from the extract occupied several times the volume of the extract itself. It was exceedingly brittle and porous. The coal insoluble in aniline, on the other hand, yielded a button similar to that given by a typical Northumberland coal; that is to say, it was compact and (if anything) slightly shrunken.

The three samples were next carbonized in the assay apparatus with the results set out in Table II.

The aniline extract could only be distilled with the greatest of difficulty. It began to decompose violently at about 450° C. to the accompaniment of crackling sounds, and swelled to such an extent as completely to fill the tube and enter the cool zone at the front end. Much brownish oil or tar was simultaneously produced. There seems no doubt that these reactions were exothermic in nature. A period of exceedingly rapid gas evolution occurred at the usual temperature of 570° C.-575° C., and it was during this phase that great expansion of the fused material took place. The residual coal exhibited entirely different properties when distilled in the Gray-King apparatus. No pronounced " peak " occurred at 575° C. and the general gas evolution curve as well as the coke cylinder obtained were found to be very similar to those associated with Northumberland coals. The composition of the gas, it should be noted, resembles closely that from the original untreated coal.

TABLE II

	(A) Original coal	(B) Aniline extract	(C) Coal insoluble in aniline
Gas yield (c.c.) ..	3,080	3,770	3,130
Equivalent in cu.ft. per ton	11,060	13,530	11,230
Calorific value of gas, B.Th.U.	575	652	588
Composition of gas (air free):	%	%	%
H_2S and CO_2 ..	2.3	1.6	2.1
Cn Hm	1.3	2.7	1.9
CO	5.1	5.7	5.3
CH_4	32.7	39.8	33.2
H_2	53.0	44.2	51.2
N_2	5.6	6.0	6.3

I should point out that both the residual coal from the aniline extraction as well as the extract itself give more and richer gas than the original coal This fact would seem to point to some depolymerization of the coal substance having taken place and given rise to bodies which on distillation produce more gas and a correspondingly lesser proportion of tar.

It seems, therefore, that the swelling propensities of a Durham gas coal can almost completely be destroyed by the extraction of from 7-10% of a constituent apparently of a predominantly resinic nature which decomposes with great rapidity at from 550° C. to 600° C.

I am inclined to think that the subsidiary peak periods of gas evolution taking place at about 640° C. and 750° C. represent the decomposition of cellulosic or humus bodies. Analyses of the gas given off at these two points are included in my final table given below:

	Temp. °C.	Temp. °C.
	640	750
H_2S and CO_2 ..	2.6	0.8
Cn Hm	0.6	—
CO	6.2	9.2
CH_4	49.0	18.2
H_2	41.4	71.2
N_2	0.2	0.6

A very rapid increase in the hydrogen content begins after 680° C., a point noted by Wheeler some 38 years ago and attributed by him to a " critical period " at which the decomposition of a less stable " paraffin yielding " resinic constituent has been practically completed and that of a more stable " hydrogen yielding " cellulosic constituent begins.

However, I do not wish further to prolong this address by entering at so late a stage into the illimitable fields of speculation. I must emphasize that the work described is of a preliminary nature only and I am indeed grateful to those members of my staff, Messrs. J. T. Lewis and G. Johnson, who have greatly aided me in bringing it to its present state.

It is hoped to extend the investigations whenever time and opportunity permit, but the study of coal and its chemical constitution is not an easy one. How many hard facts concerning it can we set down which are agreed upon by all ? Very few, I am afraid. The situation seems well summed up by Robert Boyle, who 300 years ago wrote in his " Sceptical Chymist " the following passage with which I may well conclude: " Methinks the chymists in their searches after truth are not unlike the navigators of Solomon's Tarshish fleet which brought home from their long and perilous voyage not only gold and silver and ivory, but apes and peacocks too: for so the writings of several (for I say not all) of your hermetick philosophers present us, together with divers substantial and noble experiments, theories, which either like peacock's feathers make a great show, but are neither solid nor useful, or else like apes if they have some appearance of being rational are blemished with some absurdity or other, that, when they are attentively considered make them appear ridiculous."

Coal investigators, please take note !

A Joint Civic Visit was paid to the Bede Trading Estate on May 20 by the Mayor of South Shields, Alderman Mr. M. J. Peel, and the Mayor of Jarrow, Councillor P. Scullion. Among the firms visited was Geo. Wilson Gas Meters, Ltd., and the civic visitors showed great interest in the work being carried out. They were impressed with the ability and enthusiasm of the workers, many of whom have been trained since the factory opened in June last year. They were shown meter components, both for the home and export trades, being produced in considerable quantities in a well equipped factory, which was, in fact, the first to get into production on the estate.

GAS BILL: END OF REPORT STAGE

THE Report stage of the Gas Bill, which opened on Wednesday, was completed on Friday morning after the longest sitting of the present Parliament, lasting just under 19 hours. On the first day of the Report stage, the Gas (Money) (No. 2) Resolution was agreed to on report. The Bill was then considered on report, and was recommitted in respect of certain amendments and a new clause.

Colonel Crosthwaite-Eyre (New Forest and Christchurch, C.) moved an amendment on Clause 24 (Compensation to holders of securities), providing that a holder of gas securities could ask to be paid in cash instead of gas stock.

Mr. Nigel Birch (Flint, C.) said that the Financial Secretary had stated in Committee that the Government did not expect that when the vesting date came they would do anything other than they had done in the case of electricity and transport stock. That was the reason for this amendment, because so far nobody had received what, according to the Government, he was entitled to receive.

Mr. Glenvil Hall, Financial Secretary to the Treasury, said that what they had heard was the hangover from a vendetta which had been carried on now for a good many months against the former Chancellor of the Exchequer. Resisting the amendment, he said that if holders of gas stock desired cash instead of security it was always open to them to go to the Stock Exchange and sell at any time, whether at a discount or at a premium, according to the market. They thought that was much fairer than making them elect at least one month before the vesting date. The Chancellor was in constant touch with the Bank of England and City opinion, as he had been in the case of Transport compensation stock.

Mr. Brendan Bracken (Bournemouth, C.) said it was wrong to try and attribute to Lord Catto the political decisions of the present Government. It was disgraceful that his name should be referred to in this respect.

Mr. Hall said it was quite wrong to suggest he had said the Governor of the Bank of England had in some way approved this Bill. He did not know whether he was in favour of it or not; that was immaterial. What he said was that the decision as to the value of compensation stock in the case of the Transport Act was arrived at after consultation between the Governor of the Bank of England and the Chancellor.

Mr. Bracken said Mr. Hall was merely trying to get out of a blazing indiscretion.

The amendment was negatived by 307 votes to 108—Government majority 199.

On Thursday the Bill was again considered, on recommittal, in Committee.

Sir F. Soskice, Solicitor-General, moved to extend the provisions of Clause 25 (increase of value of securities of companies suffering loss of revenue from war causes) to include not only Ordinary shares, but Preference shares.

The amendment was agreed to.

Sir F. Soskice moved to include holding companies in the provisions of Clause 25.

The amendment was agreed to.

Compensation for Severance

Mr. Robens, Parliamentary Secretary, Ministry of Fuel and Power, on Clause 28 (further compensation to local authorities in respect of severance), moved to increase the global sum available for severance compensation from £2,000,000 to £2,500,000.

Mr. R. Jennings (Sheffield, Hallam, C.) declared that the sum now offered was a guess-work figure. The rush tactics of the Government reminded him of the devil on horseback riding to hell.

Mr. I. J. Pitman (Bath, C.) said that the municipalities which owned gas undertakings were still dissatisfied with the figure of £2,500,000 compensation.

Sir W. Darling (Edinburgh, S., C.) said that the figure which ought to be in the Bill was £5,000,000.

After further debate, Mr. Robens said that the Government felt that the sum was reasonable and fair and the method of distribution would be dealt with after adequate consultation with the local authorities.

The amendment was agreed to, together with another amendment, moved by Mr. Robens, to increase the compensation to composite companies from £3 to £3 10s. for each completed 1,000 therms during 1947.

Mr. Gaitskell, Minister of Fuel and Power (Leeds, S., Lab.), moved a new clause (payment in respect of reserves of composite companies). It had been agreed, he said, that there would be difficulty under the Bill as drafted for payment of compensation to composite companies which out of their reserve fund profits had purchased a gas asset just before the vesting day. The new clause provided that where an Area Board came into possession of an asset purchased out of the water side of such a composite undertaking it was to pay the value of the asset.

The clause was read a second time and added to the Bill.

Mr. H. V. Raikes (Liverpool, Wavertree, C.) moved a new clause to give municipal authorities fair value for their undertakings. He said that about £90,000,000 worth of municipal assets was going to be acquired for somewhere about £20,000,000. If words meant anything at all that was bare-faced robbery of the municipalities.

Major S. W. Digby (Dorset, W., C.) said that here was one more example of the determination of the Government to discourage thrift.

Mr. Robens said the Government felt they were right in saying the Bill should be based on the principle that, where there was a transfer of one public utility undertaking from one public authority to another, the change should be effected without gain or without loss in any way.

The new clause was negatived by 275 votes to 94—Government majority, 181.

The recommittal stage was concluded and the Bill was considered on Report.

An Opposition amendment to obtain compensation for loss of office for directors who, before becoming members of a company board, had been wholetime employees of a gas undertaking, was defeated on a division by 201 votes to 46.

On the question of the distribution of severance compensation, Col. Crosthwaite-Eyre moved an amendment to provide that all local authorities should partake of the £2,500,000.

Mr. Robens would not go beyond the explanation—given during Thursday evening—that distribution would take place after consultation with the local authorities. If all the municipalities had to be included, he said, it would rob the clause of flexibility.

The Opposition amendment was defeated by a vote of 191 to 37.

An Intolerable Burden

Mr. Gaitskell moved an amendment to excuse directors from the penalties for paying dividends in excess of those permitted by the Bill if their recommendation were made before Jan. 23, the date of publication of the Bill, and the Minister thought there was not sufficient time before the meeting of shareholders which passed the dividend to realise what was in the Bill.

Mr. Walter Elliot (C., Scottish Universities) moved to amend the amendment by providing that directors should automatically be excused if the dividend were declared before June 10. He pointed out that even now the Bill had not become law and might be altered before it became law. Already there had been experience of the confusion that seemed to exist in the minds of Ministers between a Bill and an Act of Parliament. The idea was growing that every Bill that was introduced must become law without alteration. Ministers would soon be assuming that business men must make themselves acquainted with their speeches or even with their thoughts. The burden put upon business men was intolerable. They were expected to know not only what was in a Bill, but also how it would be altered in Committee, how it would be altered on Recommittal and on Report, and even how it would be altered by the Lords. It would have been reasonable to suggest that penal provisions should not operate until the Bill became an Act. It was unreasonable to say that business men should model their policy on the text of Bills as published.

Mr. Brendan Bracken described the clause as a "very bad example of retrospective legislation."

Mr. Gaitskell said the amendment to his amendment was quite unnecessary. The change in the Bill which he had proposed was designed to meet a very exceptional case, and it was sufficient.

The Opposition amendment to the amendment was defeated by 187 to 33, and the Government amendment was agreed to.

Col. Crosthwaite-Eyre moved an amendment to give the Minister power to increase the allowable dividend to be paid by gas companies in such cases where the dividend paid during previous years had been reduced owing to war damage suffered by the undertaking.

The amendment was negatived.

Gas Stock Terms

Colonel Crosthwaite-Eyre moved an amendment to Clause 41 (dealing with the creation of British Gas stock) by which the Opposition sought to write into the Bill that any compensation stock should have a redemption date not less than 20 years nor more than 50 years after the date of issue.

The Solicitor-General said it was not reasonable to put the date of redemption in the Bill, and when asked by Mr. Elliot when it would be announced, replied: "In due course."

The amendment was rejected by 171 to 32 votes.

A series of Government amendments to maintain dividend control of companies with varying financial years brought protests from Opposition members, who claimed it was "just another example" of retrospective legislation, which, owing to the many changes already made by the Government, would now have the reverse effect to that desired. The Opposition registered its protest by dividing the House on several other of the series of amendments under debate.

After more discussion on the Schedules the Report stage was completed.

GAS UNDERTAKINGS' RESULTS

Plymouth and Stonehouse Gas Light and Coke Company.—Net profit for the year ended Mar. 31 was £23,175, compared with £27,115 for the previous year. Final dividends are proposed at the rate of 2¼% (actual) on the Ordinary stock, making 5½% for the year; 9s. per share on the Additional shares, making 16s. 6d. per share for the year; and 8s. 6d. per share on the New shares (Act, 1879) making 15s. 6d. per share for the year, all less tax. The carry-forward, subject to final dividend, is £50,640, against £55,373 last year.

Tunbridge Wells Gas Company.—The fixed and long term assets account shows that the capital expenditure for the year was £64,000. Good progress is being made with the reconstruction of the retort house and with the provision of new boiler plant, and these two schemes account for about half this sum, the remainder being spent on the laying of mains and the purchase of meters and appliances in the normal course of business. The revenue account shows that as the result of the year's working £14,328 remains to be carried to the net revenue account. After paying Debenture and other interet the profit for the year is £6,260. For the half-year ended June 30, 1947, the Directors paid a dividend on the sliding scale stock at the rate of 7½% per annum, but as a result of the increase in the price of gas made in August last the dividend for the December half-year is reduced to £6 4s.% per annum. Gas sales in 1947 were 7.3% higher than in 1946 and 58% above the level of 1938. During the first three months of 1947 the shortage of coal and the very severe weather made it difficult to maintain the supply of gas All plant was in use, and it was only by very hard work on the part of the operators that it was possible to produce sufficient gas to meet the demand.

Temperature and Safety Controls

We understand from Mr. I. M. Perl, Managing Director of Perl Controls, Ltd., that, though this Company was recently formed, it is already actively engaged in the production and distribution of automatic temperature and safety controls claimed to be of new and improved design. Test reports, we are informed, show very satisfactory results.

Operating from works at Burwood Road, Hersham, Surrey, the Company's range of products will include direct and indirect operating thermostats, relay control valves, and flame failure and similar controls. Of particular interest to the industrial section of the industry is the anticipation that Perl Controls, Ltd., will shortly be in full production with an improved design of flame failure control, of the electro-magnetic type.

We may mention that Mr. Perl has had long experience in the gas industry and has held appointments with several prominent firms of gas appliance manufactures.

GAS STOCKS AND SHARES

With the exception of one day in March the number of dealings recorded on the London Stock Exchange last Thursday —6,749—was the lowest since Christmas. The week opened with signs of an end of the seller's market and increased and widespread sale of industrial securities, with the result that prices had their worst day since the recent downward movement set in. As the week progressed, however, there was a disposition to take a less pessimistic view of the effect of the threatened cut in Marshall aid, and business was further encouraged by the promise of the Chancellor of the Exchequer to reconsider bonus issues. British Funds finished the week at a better level than for three weeks, and the improvement in industrials which started on Tuesday was steadily maintained, though the average did not quite reach the previous week's figure.

There was a substantial fall in the total number of dealings in gas stocks, from 373 to 300, but prices generally remained unchanged. Home gas stocks were occasionally harder, but some overseas undertakings showed some decreases; on the other hand Primitiva showed a rise of 6d. compared with the previous week.

The week's rises and falls in gas stocks were as follows:

OFFICIAL LIST

Imperial Continental, cap. ...	119	—124	— 3
Montevideo, ord.	118	—123	— 4
Portsmouth & Gosport, 5 p.c. max.	101	—106	— 1
Primitiva Holdings, ord.	13/6	— 15/6	+ 6d.
South Metropolitan, ord....	96	— 99	+ 1

The Aluminium Wire & Cable Co., Ltd., 10, Buckingham Place, London, S.W.1, announces that it has transferred to its works at Swansea the manufacturing facilities for aluminium and alloy wire and hot rolled rod previously operated by the British Aluminium Co., Ltd., and Reynolds Light Alloys, Ltd. Sales of wire and rod made at Swansea will continue for the present to be handled by the British Aluminium Co., Ltd.

A most valuable addition to the laboratory or works bookshelf is the revised and re-set edition of *Bayley's Chemists' Pocket Book*, edited by F. G. Angell, B.Sc., Ph.D., F.R.I.C. Although of small dimensions, the volume contains over 500 pages and is strongly bound; the clarity of type leaves nothing to be desired. The contents are so many and varied that it is impossible to do more than list some of the general sections: Mathematical principles, weights and measures, the reduction of gases to normal temperature and pressure, hygrometry, tables for the conversion of thermometric degrees, qualitative analysis, analysis of mixtures and of sugar, milk, wines, and oil, gravimetric analysis, volumetric analysis, volumetric solutions with coefficients, gas analysis, gas volumetric analysis, photography, and miscellaneous tables and formulae. The published price is 30s., postage 6d.

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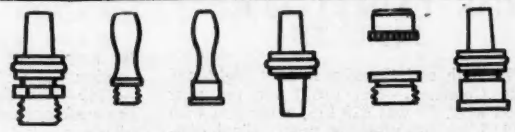

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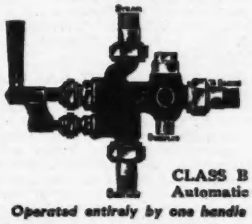

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CONTRACTS OPEN

ACCRINGTON DISTRICT GAS AND WATER BOARD

TENDERS are invited for the supply, delivery and erection, at the Board's Great Harwood Gasworks, of a four-lift SPIRALLY GUIDED GASHOLDER of 2 million cu.ft. capacity, with steel tank, the whole to be of riveted construction.

Full particulars, specification, conditions of contract and form of tender can be obtained from A. Harrison, M.Inst.G.E., Engineer and General Manager, General Offices, St. James' Street, Accrington.

Tenders, enclosed in plain sealed envelopes endorsed "Tender for Gasholder," should be addressed to the Chairman and Members, Accrington District Gas and Water Board, St. James' Street, Accrington, to be received not later than Monday, July 12.

The Board do not bind themselves to accept the lowest or any tender.

A. HARRISON,
General Manager.

General Offices,
St. James' Street,
Accrington.

June 1, 1948.

TENDERS are invited for 72 PURIFIER GRIDS approximately 4 ft. 11⅛ in. by 2 ft. 5¼ in. by 1¼ in., 25 laths a grid exclusive of frame. Constructed of taper deal bars, strong oak frames, planed on all surfaces.

The Grids to be suitably bolted together and have generally strong structure.

Quotations covering the cost of delivery to the Gasworks, Wombwell, and stating the period of delivery should be sent to reach the undersigned on or before Saturday, July 3, 1948.

F. POTTER,
Clerk of the Council.

Town Hall,
Wombwell.

SPENBOROUGH URBAN DISTRICT COUNCIL

(GAS DEPARTMENT.)

NEW GAS EXHAUSTER SET.

TENDERS are invited for the supply and erection at the Cleckheaton Gas-works of a steam-driven Roots or Connersville type EXHAUSTER SET, capacity 175,000 cu.ft. per hour, HYDRAULIC GOVERNOR, &c., together with an AIR-BLOWER, for purification purposes, of similar type to that of the exhauster.

The specification can be obtained from the Engineer, Mr. Arthur L. Jennings, M.Inst.Gas E., Gas-works, Cleckheaton.

Tenders, in envelopes sealed and endorsed "Gas Exhauster" and bearing no name or mark to indicate the senders, must be delivered to the undersigned not later than Saturday, July 3, 1948.

D COUPE,
Clerk of the Council.

Town Hall,
Cleckheaton.
May 31, 1948.

COUNTY BOROUGH OF ROCHDALE

(GAS DEPARTMENT.)

TENDERS are invited for the supply, delivery and erection at the Gas-works, Dane Street Rochdale, of an installation of OXIDE PURIFIERS consisting of six boxes 40 ft. square in sets of three built at ground level, together with foundations, all valves, mains and connexions, oxide storage bays and oxide handling plant.

Specification and details of conditions of contract may be obtained from the Engineer and Manager, Gasworks, Dane Street, Rochdale.

Tenders, in plain sealed envelopes, endorsed "Purifiers," should be addressed to the undersigned and must be received not later than 12 noon on Saturday, July 17, 1948.

The Corporation do not bind themselves to accept the lowest or any tender.

G. F. SIMMONDS,
Town Clerk.

Town Hall
Rochdale.,
June 5, 1948.

NEWPORT (MON.) GAS COMPANY

TENDERS are invited (with earliest date for completion) for the supply, delivery and erection of the following plant :

1. One standard type 2,000,000 cu.ft. capacity SPIRALLY GUIDED GASHOLDER in steel tank above ground, complete in every respect with inlet and outlet connexions, anti-freezing equipment, &c.
2. One standard type of CYLINDRICAL H.P. GASHOLDER of 30,000 cu.ft. capacity at alternatively (*a*) 80 lb. per sq. in. pressure, and (*b*) 100 lb. per sq. in. pressure, to be installed on foundations to be provided by the Company.
3. The necessary COMPRESSING PLANT for the H.P. holder of 6,000 cu.ft. per hour capacity to be electrically driven from a supply of 400 volts, 3-phase, complete with automatic starter, time control and all necessary ancillary equipment.

Tenders are also invited for the FOUNDATIONS for the 2,000,000 cu.ft. holder referred to above.

Full particulars may be obtained from Mr. J. F. Rust, M.Inst.Gas E., the Company's Chief Engineer, at Mill Street, Newport, Mon.

The Company does not bind itself to accept the lowest or any tender, and reserves the right to accept the whole or part of any tender.

R. S. SNELLING,
General Manager and Secretary.

Mill Street,
Newport, Mon.
June 7, 1948.

(*Classified advertisements continued on Supplement* 4)

COOKER RENOVATION

EVERY month hundreds of renovated Cookers leave our works for delivery to Gas Undertakings in all parts of the country. If you have not yet solved your Black Cooker problems we invite you to get in touch with us. W. H. COOPER & Co. (WEST END), LTD., 21, Napier Road, Bromley, Kent. Ravensbourne 6537.

PLANT FOR SALE & WANTED

FOR SALE. 10 ton POT STILL, complete with all fittings, in good condition. Apply A. KING & SONS, 110 Ber Street, Norwich, Norfolk.

FOR SALE. 1,500 gall. cast iron SECTIONAL TANK, in good condition. Delivery without dismantling if required. Apply A KING & SONS, 110, Ber Street, Norwich, Norfolk.

WANTED. St. Helens Corporation Gas De-partment desires to purchase either a CONNERSVILLE or B.M. METER, having a capacity of approximately 60,000 cu.ft. per hour. State if by-pass with valves available.

WANTED. EXHAUSTER or TURBO BLOW-ER in serviceable condition without valves or regulator, capacity not less than 25,000 cu.ft. per hour. Reply to No. 9736, "GAS JOURNAL," 11, Bolt Court, Fleet Street, London, E.C.4.

WANTED. Fan-type GAS BOOSTER with or without electric motor. Minimum capacity 15,000 cu.ft. per hour. Particulars to ENGINEER AND MANAGER, Gas-works, Tyldesley, Lancs.

WANTED. One or more secondhand cast iron PURIFIER BOXES, about 20 ft. square, with or without covers, preferably dry lute, but wet lute considered if capable of conversion. Capable of being satisfactorily dismantled and re-erected. Reply, giving particulars, to the ENGINEER AND MANAGER, Gas-works, Ashford, Kent.

PHONE 98 STAINES.

FOR SALE. Six ENCLOSED RECTANGULAR TANKS, 12 ft. by 6 ft. by 6 ft. Two 2,000 g.p.h. vertical boiler FEED PUMPS. Steam-driven COMPRESSOR, 165 cu.ft. at 80 lb. LANCASHIRE BOILER, 28 ft. by 8 ft., 150 lb. 30 h.p. BRUSH ELECTRIC MOTOR, 415/3/50, 720 revs. 50 h.p. Bellis H.S. enclosed STEAM ENGINE. 7 h.p. Crossley GAS ENGINES. HARRY H. GARDAM & Co., LTD., Staines.

APPOINTMENTS VACANT

None of the vacancies in these columns relates to a man between the ages of 18 and 50, inclusive, or a woman between the ages of 18 and 40, inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order, 1947, or the vacancy is for employment excepted from the provisions of that Order.

OPERATORS and CONTRACT SUPERVI-SORS required for all types of carbonizing plant. State age, general and Technical education and experience, together with salary required. Apply in writing to W. J. JENKINS & Co., LTD., Beehive Works, Retford, Notts.

BILSTON GAS LIGHT AND COKE COMPANY, LIMITED

APPLICATIONS are invited for the appoint-ment of TECHNICAL ASSISTANT AND RELIEF SHIFT SUPERINTENDENT to the above Company.

Candidates should have experience in the control of continuous vertical retorts and be capable of supervizing steam raising and other mechanical plant.

The successful applicant will be required to join the Company's pension scheme.

Applications, stating age, experience and salary required, and accompanied by the names of two referees, should be forwarded to the undersigned on or before June 26, 1948.

F. HARVEY,
Engineer and Manager.

Gas-works,
Ward Street,
Ettingshall,
near Wolverhampton.

URBAN DISTRICT COUNCIL OF ELLESMERE PORT

(GAS DEPARTMENT.)

APPOINTMENT OF TECHNICAL ASSISTANT

APPLICATIONS are invited from persons who have had experience in the control of vertical retorts and benzole extraction plant, and who are capable of carrying out all works routine tests, at a salary within Grade I of the Miscellaneous Division of the National Salary Scales.

Applications, stating age, qualifications and experience, together with *copies* of not more than two recent Testimonials, must reach the undersigned not later than noon on Saturday July 3, 1948.

P. J. HODGES,
Clerk of the Council.

Council Offices,
Ellesmere Port.
June 10, 1948.

TOTTENHAM AND DISTRICT GAS COMPANY

APPLICATIONS are invited for the position of SHIFT SUPERINTENDENT at the Willoughby Lane Works of the above Company. Candidates should preferably have had experience on Woodall-Duckham, I.V.C.'s, C.V.'s, and carburetted water gas plant. The salary will be according to experience but not less than £450 per annum. Applications, giving full particulars of qualifications and experience, should be sent to the PERSONNEL OFFICER, Tottenham and District Gas Company, Woodall House, 658, Lordship Lane, Wood Green, N.22.

TOTTENHAM AND DISTRICT GAS COMPANY

APPLICATIONS are invited for the position of HOME SERVICE ADVISER on the Eastern Area of the above Company. Applicants must hold the City and Guilds Certificate in Cookery (Ordinary Grade) and possess the ability to lecture and demonstrate to audiences without assistance. Duties consist of developing the work of the Home Service Section under the general direction of the Area Manager and the suitable candidate will be employed in the Tottenham district. Salary will be according to age and experience. Applications, giving full particulars of qualifications and experience, should be sent to the PERSONNEL OFFICER, Tottenham and District Gas Company, Woodall House, 658, Lordship Lane, Wood Green, N.22.

CITY OF BIRMINGHAM

(GAS DEPARTMENT)

APPLICATIONS are invited from young men up to 30 years of age, with First or Second Class Honours degree, for the following positions on a specialist staff working in large modern, centralised laboratories:

(1) CHEMIST or PHYSICIST among whose duties will be testing of refractories. A sound, practical experience with X-ray crystallographic technique is essential in this and similar branches of physical chemistry.

(2) PHYSICIST for dealing with much of the physical work connected with gas-works practice. An interest in indicating and recording instruments—temperature, flow, pressure, &c.—will be an advantage.

(3) CHEMIST or PHYSICIST. As a large proportion of the work will be connected with abstracting, collating and reporting from technical literature, and the treatment of technical data on modern statistical lines, an acquaintance with or liking for these subjects will be a decided advantage.

(4) CHEMIST to join research staff dealing with problems in the important and very promising field connected with gas manufacture. An aptitude for organic chemistry will be an advantage.

Salaries for positions (1), (2) and (3) will be up to A.P.T. Division VI of the National Joint Council Scales, viz, a maximum of £660 per annum, according to age, qualifications and experience.

For position (4) the range will be up to A.P.T. Division VII, viz., a maximum of £710 per annum, according to age, qualifications and experience.

The appointments will be subject to the provisions of the Local Government Superannuation Act, 1937, and the successful candidates will be required to pass a medical examination.

Applications, stating age training, qualifications and experience, together with the names of two persons from whom references can be obtained, should be addressed to the undersigned, to arrive not later than Monday, July 19, 1948.

ALEX. W. LEE,
General Manager and Secretary.

City of Birmingham Gas Department.
The Council House,
Birmingham, 3.

CLERK OF WORKS required, used to civil engineering, knowledge of foundations, reinforced concrete structures, steel-framed structures, installation of plant machinery, pipelines, &c. One used to gas and water engineering preferred.

Salary £9 to £9 10s. per week according to experience.

Applications, giving full particulars of age, training and qualifications, with *copies* of two recent Testimonials, to ENGINEER AND GENERAL MANAGER, The Bournemouth Gas and Water Company, 136, Old Christchurch Road, Bournemouth.

SENIOR GENERAL ENGINEERING DRAUGHTSMAN required with knowledge of gas and/or water works plant, with special reference to structural steel and reinforced concrete work, including the taking out of quantities and preparing specifications. Salary £9 to £9 10s. according to experience. Applications, giving full particulars of age, training and qualifications, with *copies* of two recent Testimonials, to ENGINEER AND GENERAL MANAGER, The Bournemouth Gas and Water Company, 136, Old Christchurch Road, Bournemouth.

COUNTY BOROUGH OF DARLINGTON

(GAS DEPARTMENT.)

JUNIOR ENGINEERS.

APPLICATIONS are invited from young men with engineering or chemical training and holding a Higher National Certificate or equivalent, for the position of JUNIOR ENGINEER. The persons appointed will be trained for the position of Shift Engineer.

Salary in accordance with Grade II, Miscellaneous Division of the National Scale of Salaries, commencing at £375, and rising to £420 per annum.

The successful candidates will be required to pass a medical examination.

Applications, endorsed "Junior Engineer," stating age, particulars of training, experience and qualifications, together with *copies* of not more than two Testimonials, to be delivered to the GAS ENGINEER AND MANAGER, Gas-works, John Street, Darlington, on or before Saturday, June 26, 1948.

Amended advertisement.

THE Colchester Gas Company require a CAR-BONIZING SUPERINTENDENT to take charge of a new continuous vertical retort house. Salary £500 per annum.

Applications, stating age, experience, and present engagement, should be sent to the undersigned.

Exempted from the Control of Engagement Order.

MAURICE L. SMITH,
Engineer and Manager.

The Colchester Gas Company,
Gas-works,
Colchester.

CITY OF LEICESTER

(GAS DEPARTMENT.)

ENGINEERING DRAUGHTSMAN.

APPLICATIONS giving details of age, education training, qualifications and experience are invited for the post of ENGINEERING DRAUGHTSMAN. The salary will be in accordance with Grade IV of the A.P. & T. Division of the National Scale of Salaries (£480, rising by annual increments of £15 to £525.)

Applicants must have experience of gas plant and structural engineering, be capable of dealing with the laying out of gas-works buildings and plant, and drawing up specifications and bills of quantity, &c.

The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and the successful candidate will be required to pass a medical examination.

Applications should be forwarded to the Engineer and Manager, Gas Offices, Millstone Lane, Leicester, not later than June 28, 1948.

Candidates must disclose whether to their knowledge they are related to any member of the Leicester City Council or senior officer employed by the Council.

K. L. PEARCE, M.Inst.Gas E.,
Engineer and Manager.

Gas Offices,
Millstone Lane,
Leicester.
June 7, 1948.

By permission of the Ministry of Labour and National Service under the Control of Engagement Order, 1947.

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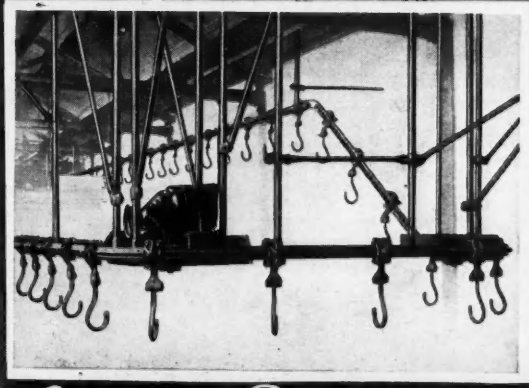

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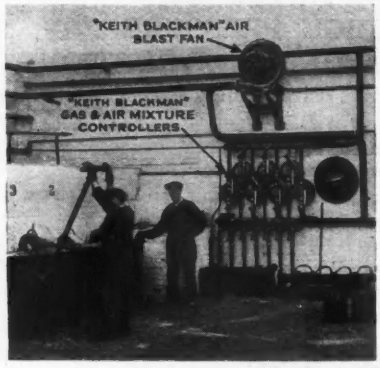

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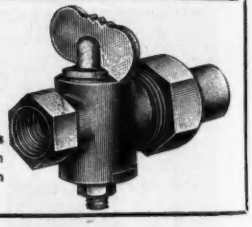

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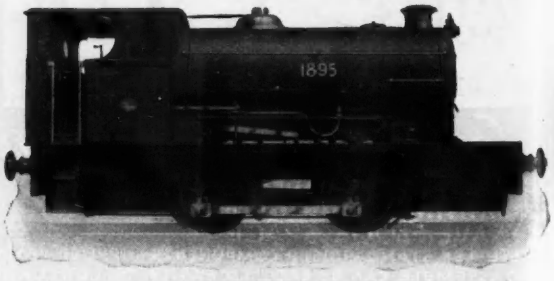

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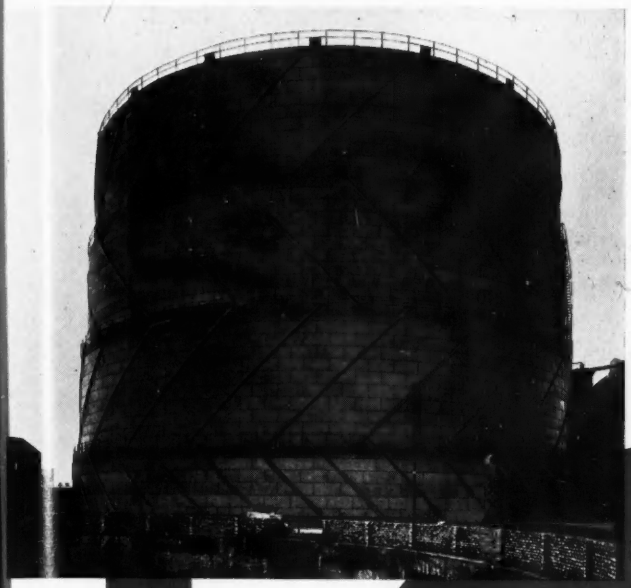

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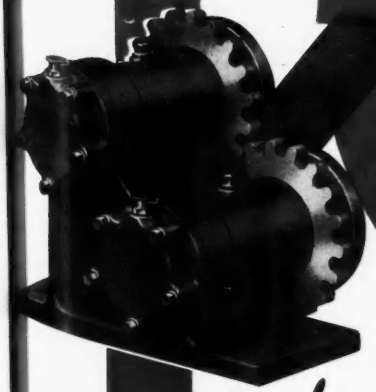

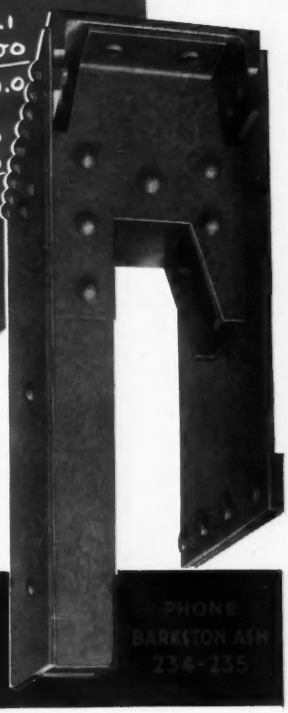

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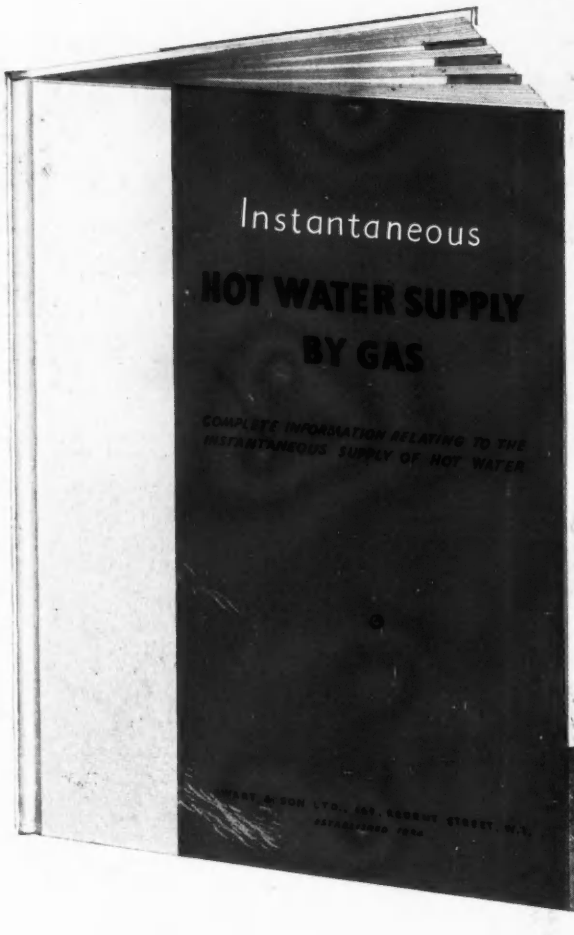

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